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AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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Vertical Plate-bending Rolls.

As an example of what has been done in the way of the development of plate-bending rolls in this country since the beginning of the rebuilding of the navy, we present on this page an illustration of a set of vertical bending rolls made by the Niles Tool Works, of Hamilton, O. Two of these machines have been built, one for the Boston and the other for the Mare Island Navy Yard.

As will be seen, the whole machine is mounted upon a heavy bed-plate which is placed at the bottom of a pit, while above this, and about on a level with the floor line, is the lower housing, to an extension of which the engines for driving and adjusting the rolls are attached.

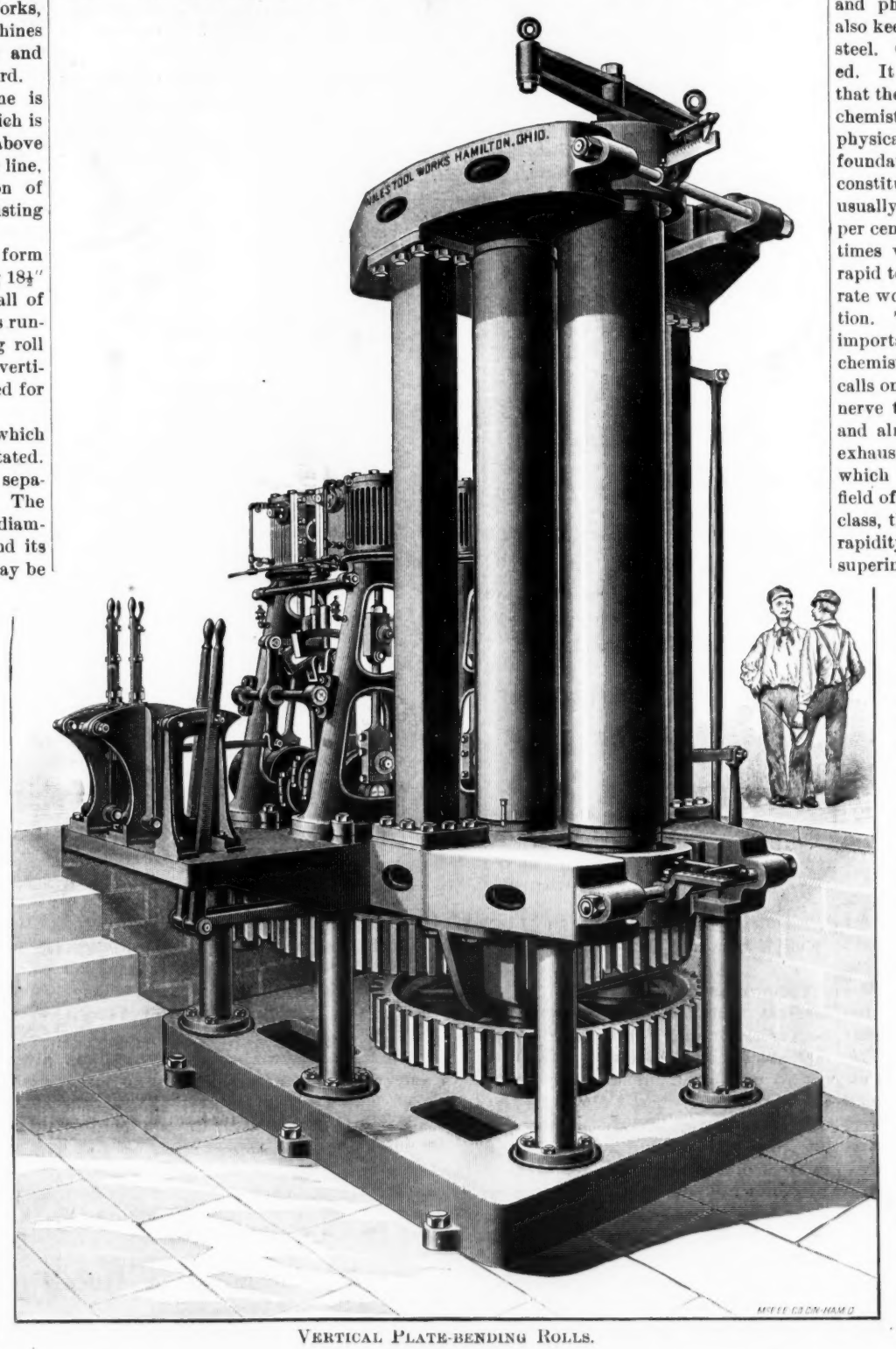
There are three rolls arranged in the form of a triangle, the bending roll being 18½″ diameter and the feeding rolls 15½″—all of wrought-iron with very large journals running in brass bushings. The bending roll is adjusted by power, a pair of 6″x7″ vertical link motion engines being provided for this.

Suitable indicators are provided, by which the adjustment of this roll is facilitated. Either end of the roll may be moved separately, or they may move together. The screws which move this roll are 6½″ diameter. The roll is counterbalanced, and its upper bearing so arranged that it may be thrown back, permitting the roll to be hoisted full height whenever it is desirable to do so, to remove the plate.

The feed rolls are driven by steel pinions gearing into a steel driving pinion which is common to both, and receives motion through a train of gearing from a pair of 8″x10″ vertical link motion engines. The gearing is very heavy, is below the floor line, out of the way, and is supported at each side, above by the lower housing and below by the bed-plate.

The housings are of the box form, very heavy, and are united by hollow columns of rectangular section, so placed as to leave the front of the machine entirely unobstructed.

The machine is capable of bending plates up to 1½″ thick, 10 feet wide, and is intended to withstand the severest usage of the shipyards.



VERTICAL PLATE-BENDING ROLLS.

At a recent meeting of the Leeds Association of Engineers, a paper was read on "Cutting Tools, their Form, Edge and Tempers," by Mr. Holgate, who said he was of opinion that for a workman to make a good machine it was desirable that he should have been a hand turner, for the latter learnt how to humor his hand tools so as to get the best results with the least trouble. For wrought-steel and wrought-iron a quicker cutting speed is desirable than for cast-iron and steel; water can be used, and the tools must be ground to afford a better relief for the cuttings. A self-hardening tool steel is not suitable for wrought-iron or steel, for water cannot be used with such steel. Turning tools should not always cut at the same point, say, the exact level of the center, or above or below the center, but generally speaking, a little above the center line is the best place to apply the tool.

He preferred four grooves in a tap to three only.

Tool holders answered very well in slotting and planing machines, but he did not find them generally useful for lathes.

The United States has taken a hand in the Sugar Trust, by beginning an action with a view of declaring invalid the sales of several Philadelphia sugar refineries to the trust, on the ground that the trust seeks to monopolize the manufacture and sale of refined sugar in the United States; that it has limited production and increased prices; in a word, that the whole matter is an unlawful scheme to control the price of sugar, and that the combinations operate to restrain trade.

Chemistry in the Foundry.

BY PROFESSOR JOSEPH TORREY.

I read Mr. Bolland's paper in the AMERICAN MACHINIST of a week or two ago with a great deal of interest. The question of the physical properties of iron and steel as related to its chemical composition has been a fascinating one ever since the rise of chemical metallurgy in connection with the Bessemer process. Early in the history of that important and far-reaching process it was found that sulphur and phosphorus must be avoided, so far as possible, in the steel, and, hence, of course, in the pig-iron, and, still further back, in the ores from which the pig-iron was smelted. The percentage of carbon was also known to be important, and silicon was early discovered to be the reservoir of heat which must be rightly regulated if hot and cold "blows" were to be avoided. Thus the work of the old-time steel works chemist consisted at first in keeping track of the carbon, sulphur and phosphorus in the ores and pig, and also keeping a constant carbon record of the steel. Of late his duties have greatly widened. It was not for several years, however, that there was any serious work done on the chemistry of iron and steel as related to its physical properties. There was no real foundation for such study. Most of the constituents of either steel or iron were usually present in small fractions of one per cent., and the analytical methods of the times were neither sufficiently accurate or rapid to allow of the great amount of accurate work demanded in such an investigation. The question was, however, rising in importance, and so it happened that the chemists, under the pressure of immense calls on their resources, and straining every nerve to meet demands often unreasonable and almost impossible, evolved, by dint of exhaustive, painstaking work, the like of which has never been seen in any other field of chemistry, methods which are, as a class, the most remarkable combinations of rapidity and accuracy in existence. The superintendent of a Bessemer works would say to his chemist, "I must have these forty silicon determinations by this noon"; and the poor chemist, instead of pitching all the furniture in the ill-equipped laboratory at his superior's head, and taking immediate leave, simply went to work and did the impossible, and employed his hard-earned experience in evolving more rapid and accurate methods.

With the advent of better analytical methods began the war which has raged ever since, between the many who expected to be able to predict physical properties from chemical analysis, and the few who were and always have been rather skeptical. It appeared as time went that the question was not, to say the least, simple, and that, moreover, as experiments multiplied the conclusions to be drawn from them seemed less and less obvious. There are on record many investigations, each embracing a great many separate samples with every important detail of physical and chemical examination recorded, and yet from these data most diverse and conflicting conclusions can be and are drawn by men of large experience and thorough knowledge. For instance, it soon appeared that there was more to the chemical question than appeared at first sight. The percentage of silicon in a car-wheel iron was not the true index of the depth of chill it would give. It is a part of metallurgical history in America that when the hot blast was introduced in blast furnaces the charcoal furnaces seized eagerly on the idea as a great measure of economy, and what was the result? Simply this: They put hot blast on their charcoal furnaces and the iron came out, under the carefully regulated system

of charges, the same chemically as before but it *would not chill*. It contained the same percentage of silicon, and was, as previously stated, the same iron, so far as chemistry could show, *and yet for a car wheel iron it was good for nothing*. Any one who wishes can look up the matter and verify my statements.

Now here was certainly a most remarkable anomaly, and chemists were practically forced to the conclusion that silicon in hot blast iron and silicon in cold blast iron were two different things, and lately (comparatively) it has been found that the silicon is present in cast-iron in at least two modifications. So far as I know the question has not been settled as to the nature of these modifications. The writer began several years ago an investigation never completed, which had for its object the influence of each of these modifications of silicon on the chilling properties of car wheel iron. It was found that when cast-iron was treated with the double chloride of copper and ammonium some of the silicon dissolved and some did not, and this was made the basis of the investigation. A number of samples of car wheel iron were kindly furnished by a large car wheel iron firm. Each one had its depth of chill and all other necessary data recorded. The specimens were of many different qualities, and it was hoped that some conclusion could be arrived at from the comparison of the chemical and chilling properties. For instance, it might be found that in the good chilling irons the silicon was all or mostly in the form which dissolved in copper and ammonium chloride. If so, then all that would be necessary in order to judge of the quality of a chilling iron would be to treat it with copper and ammonium chloride, having previously determined the total silicon by the ordinary method. If most of the silicon was found to be dissolved by the chloride solution then the iron would probably chill well.

The investigation was interrupted before it was ever completed. I cannot say that anything very definite was arrived at. The results obtained certainly had in them a little encouragement, but nothing conclusive appeared. I believe, however, the principle to be a good one, and think that more experiments might prove profitable. Possibly it has all been done. I have not access to much literature of the iron and steel laboratories now.

But to return to the point at which this digression began. As soon as it became recognized that there were two forms of silicon in cast-iron, it flashed on the minds of metallurgical chemists that this idea applied to others of the constituents of steel and iron might explain some otherwise unexplainable things. For instance, it was noticed that wrought-iron could apparently carry a larger percentage of phosphorus without injuring its quality than Bessemer metal could. It was thought by some that the phosphorus, like silicon, might be present in more than one form in the same piece of iron, and that phosphorus in iron and phosphorus in Martin or Bessemer metal might be two different things. This is undoubtedly the fact. Whether it explains all it is supposed to is another question. It also appeared that there were records of Bessemer metal which contained much more phosphorus than would be allowed ordinarily, and which nevertheless rolled well and made good rails; but it took a long time for metallurgists to learn that in many cases the explanation was simply that steel very low in carbon could carry considerable phosphorus without harm. And this brings me to another point, namely, that one of the leading difficulties in the study of the chemical and physical properties of iron is the way in which the constituents depend on each other. For instance, we have just seen that phosphorus, say 0 3 per cent. with 0 002 per cent. carbon, and 0.3 per cent. phosphorus with 0.08 per cent. carbon are two widely different combinations.

One of the most memorable investigations in this important field was that of Dr. Charles B Dudley, chemist of the Pennsylvania Railroad. The problem was to determine, if possible, the relation between the chemical and physical data of a steel rail and its wearing capacity. The first paper which was read before the American Institute of Mining Engineers comprised tests made on, I think, twenty-three rails taken from the track on different grades, curves and tangents, so as to get as many different conditions of wear as possible. The second one was much more exhaustive and complete, and consisted of tests made on seventy-five more rails. It is impossible even to give an abstract of the paper in satisfactory form. Suffice it to say that Dr. Dudley concluded that the softer rails showed the better wear, and he accordingly made up from the data at hand a chemical composition for steel rails which he thought would give good results, and in his report to the Pennsylvania Railroad (the paper was presented in the form of a report) he recommended the purchasing of steel rails by his formula. I do not know that the results have been anything but good, but it is only fair to state that Dr. Dudley's conclusions were very severely criticised by the most prominent metallurgists in America.

Standard Sizes of Screw Threads for Bolts and Taps, adopted by The Warder, Bushnell & Glessner Co. in 1884. Chas. A. Bauer, General Manager.

1	2	3	4	5	6	7	8	9	10
A.	n.	D.	d.	h.	f.	D′—D.	D′.	d′.	H.
¼	20.	.2608″	.1855″	.0379″	.0062″	.006″	.2668″	.1915″	.2024″
5/16	18.	.3245″	.2403″	.0421″	.0070″	.006″	.3305″	.2463″	.2589″
⅜	16.	.3885′	.2938″	.0474″	.0078″	.006″	.3945″	.2998″	.3139″
7/16	14.	.4530″	.3447″	.0541″	.0089″	.006″	.4590″	.3507″	.3670″
½	13.	.5166″	.4000″	.0582″	.0096″	.006″	.5226″	.4060″	.4236″
9/16	12.	.5805″	.4543′	.0631″	.0104″	.007″	.5875″	.4613″	.4802″
⅝	11.	.6447″	.5069″	.0689″	.0114″	.007″	.6517″	.5139″	.5346″
¾	10.	.7717 ′	.6201″	.0758″	.0125″	.007″	.7787′	.6271″	.6499″
⅞	9.	.8991″	.7307″	.0842″	.0139″	.007″	.9061″	.7377″	.7630″
1	8.	1.0271″	.8376″	.0947″	.0156″	.007″	1.0341″	.8446″	.8731″
1⅛	7.	1.1559″	.9394″	.1083″	.0179″	.007″	1.1629″	.9464″	.9789″
1¼	7.	1.2859″	1.0644″	.1083″	.0179″	.007″	1.2879″	1.0714 ′	1.1039″

A = nominal diameter of bolt.
D = actual diameter of bolt.
d = diameter of bolt at bottom of thread.
n = number of threads per inch.
f = flat of bottom of thread.
h = depth of thread.
D' and d' = diameters of tap.
H = hole in nut before tapping.

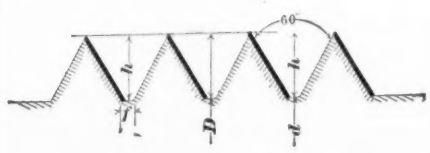
$$D = A + \frac{.2165}{n}$$

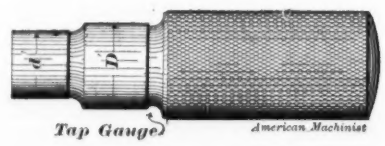
$$d = A - \frac{1.29904}{n}$$

$$h = \frac{.7577}{n} = \frac{D - d}{2}$$

$$f = \frac{.125}{n}$$

$$H = D' - \frac{1.288}{n} = D' - .85\,(2\,h)$$





The Maximum Variation in Size of Rough Iron for U. S. Standard Bolts.

The production of standard screw threads involves problems, many of which have been satisfactorily solved, while others, mechanics and manufacturers generally, are not so certain of. In a sewing machine shop or armory, where all threads are cut upon stock previously reduced accurately to size, the problem differs essentially from that which is presented in a car shop or in a manufactory of agricultural machinery, where a large proportion of the threads are cut upon rough iron. And when it happens that threads of both kinds are to be cut in the same establishment, the problem is still further complicated.

The adoption of the Sellers thread as the standard form simplified the problem considerably, from the fact that taps and dies keep their size much longer in use when flatted in accordance with this system than when sharp, though it has been found advisable in practice in most cases to make the taps of somewhat larger outside diameter than the nominal size, thus carrying the threads up a little further towards the V shape and giving corresponding clearance to the tops of the threads when in the nuts or tapped holes, this plan also allowing for some wear on the extreme points of the threads of the taps without affecting the fit of the sides or angles of the threads, at which point good practice now requires that all threads shall be measured.

The most serious difficulty encountered after the adoption of the Sellers thread was found to arise from the difficulty in getting stock rolled close enough to gauge to admit of threads being cut upon it which should conform to the standard. Car builders especially were bothered by this problem, and finally, by the action of the Master Car Builders Association, at their 17th annual convention, held in Chicago in 1883, limit gauges were adopted, to which it was understood all round bar iron to be used in the construction of cars, and especially for the bolts of cars, was to be rolled. According to the scheme of these gauges, ¾″ round iron must pass through a snap gauge .255″ in size, and must not pass through one .245″ in size, thus limiting the variation in this size of iron to not more than .005″ below the nominal diameter and the same above it, the total range of permissible variation being .01″. The limit of variation then increases .001″ with each larger size of iron, the limit for 1¼″ iron being .0105″ each way from the nominal diameter, or .021″ total variation. This would seem to give ample range, and there is no doubt that iron ought to be kept within these limits; but as a matter of fact it is not generally kept within these limits, as an investigation of the matter will show, and many car builders and others who make rough bolts are finding great difficulty in keeping to the standard threads on this account.

Makers of taps and dies, who are almost without exception in favor of the exclusive use of the Sellers or U. S. Standard threads, often have calls for taps and dies, U. S. Standard "for rough iron", such orders coming from those who believe that such a thing as a U. S. Standard tap or die can be made larger than the nominal diameter or to suit the size to which iron may be rolled; and no doubt most of those who so order think that if there are no such taps and dies then there ought to be.

An examination of rough iron will show that much of it is rolled out of round to an amount exceeding the limit of variation in size allowed.

In view of all this it may be desirable to know what the extreme variation in iron may be, consistent with the maintenance of U. S. Standard threads, *i. e.*, threads which are standard when measured upon the angles, the only place where it seems advisable to have them fit closely, and in this connection we propose to review what has been done by Mr. Chas. A. Bauer, the general manager of the Warder, Bushnell & Glessner Co., at Springfield, Ohio.

In this establishment 4,000,000 to 5,000,000 bolts are made and used annually. Most of these are made from rough iron, but many of them are, previous to being threaded, turned or finished to size in screw machines. These two classes of bolts are used mostly in nuts or holes which have been tapped with machine taps made in the establishment, while there are yet others which are usually turned and threaded in the lathe, these being used in the building and repairing of special machinery and tools used in the works; Pratt & Whitney's make of U. S. Standard hand taps, in sets of three, being used for this work. Previous to Mr. Bauer's advent the system there was the same as that found in most establishments of that character, then and now, *i. e.*, there was no system, and every practical mechanic will understand what that means without further explanation. The problem of how to bring order out of this particular chaos presented itself to Mr. Bauer about the time of the adoption of the standards of the M. C. B. A., and his solution (the scheme described below) has been in use there since 1884.

The main features of the plan may be stated briefly as follows: All bolts, whether cut from rough or finished stock, are standard size at the bottom, and at the sides or angles of the threads, the variation for fit of the nut and allowance for wear of taps being made in the machine taps. Nuts are punched with holes of such size as to give 85 per cent. of a full thread, experience showing that the metal of wrought nuts will then crowd into the threads of the tap sufficiently to give practically a full thread, while if punched smaller some of the metal will be cut out by the tap at the bottom of the threads, which is of course undesirable. Machine taps are made enough larger than the nominal to bring the tops of the threads up sharp, plus the amount allowed for fit and wear of taps. This allows the iron to be enough above the nominal diameter to bring the threads up full (sharp) at top, while if it is small the only effect is to give a flat at top of threads; neither condition affecting the actual size of the thread at the point at which it is intended to bear. Limit gauges are furnished to the mills, by which the iron is rolled, the maximum size being shown in the third column of the table given herewith, while the minimum diameter, which is not given, may be the same as that of the M. C. B. A., since a smaller limit is practicable below the nominal size than above it, the tendency in rolling being nearly always to exceed the nominal diameter.

In making the taps the threaded portion is turned to the size given in the eighth column of the table, which gives 6 to 7 thousandths of an inch allowance for fit and wear of tap. Just above the threaded portion of the tap a place is turned to the size given in the ninth column of the table, these sizes being the same as those of the regular U. S. Standard bolt, at the bottom of the thread, plus the amount allowed for fit and wear of tap; or, in other words, d' = U. S. Standard $d + (D' - D)$. Gauges like the one shown below the table are furnished for this sizing. In finishing the threads of the tap a tool is used which has a removable cutter finished accurately to gauge by grinding, this tool being correct U. S. Standard as to angle, and flat at the point. It is fed in and the threads chased until the point, or, rather, the flat on this tool just touches the portion of the tap which has been turned to size d'. Care having been taken with the form of the tool, with its grinding on the top face (a fixture being provided for this to insure its being ground properly), and also with the setting of the tool properly in the lathe, the result is that the threads of the tap are correctly sized without further attention.

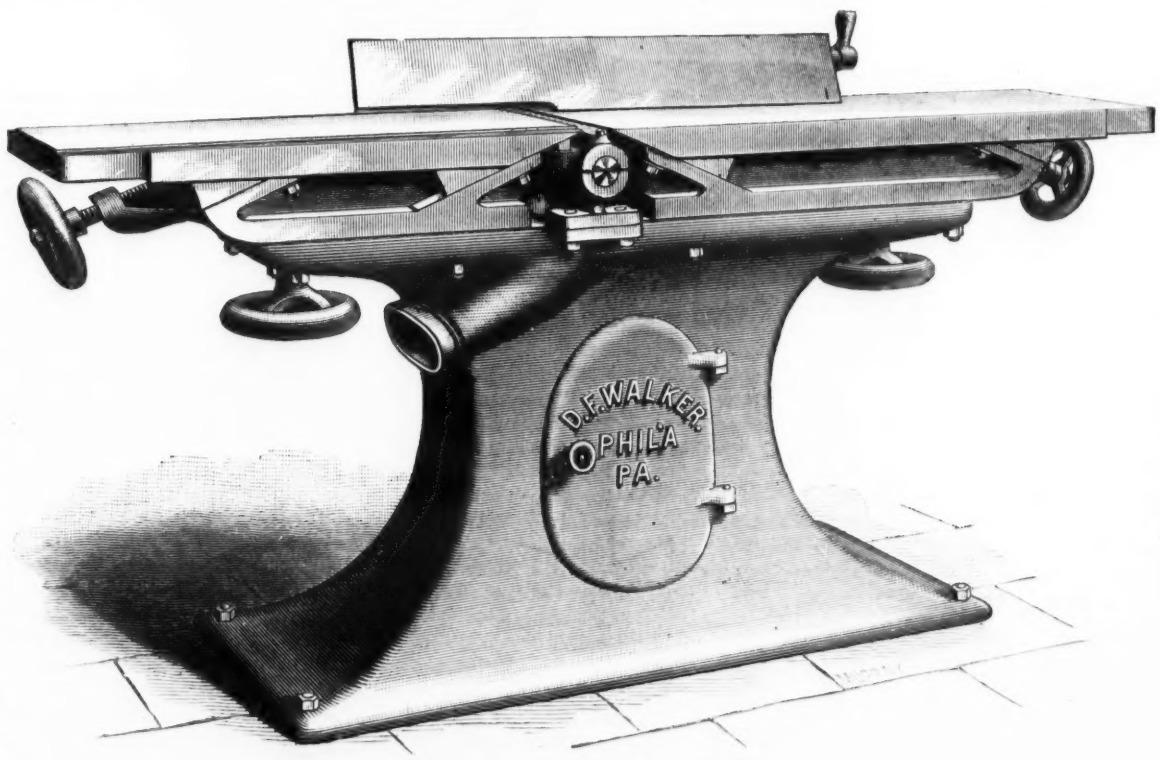
The table, with the formula as given by Mr. Bauer, explains itself, and we are able to say, as a result of personal experience with

the system, that it works well. Of course it is evident that one of the points of advantage of the Sellers system is sacrificed, *i. e.*, instead of the taps being flatted at the top of the threads they are sharp, and are consequently not so durable as they otherwise would be; but practically this disadvantage is not found to be serious, and is far overbalanced by the greater ease of getting iron within the prescribed limits; while any rough bolt when reduced in size at the top of the threads, by filing or otherwise, will fit a hole tapped with the U. S Standard hand-taps before referred to, thus affording an easy practical proof, and one frequently given incidentally, that the two kinds of bolts or screws made for the two different kinds of work are practically interchangeable. Assuming the same minimum diameter for iron as that allowed by the M. C. B. A. gauges, ¼″ iron by this system can be .005″ smaller or .0108′ larger than the nominal diameter, or, in other words, it may have a total variation of .0158″, while 1¼″ iron can be .0105″ smaller or .0309″ larger than nominal—a total variation of .0414″—and within these limits it is found practicable to procure the iron.

It is common practice now, where U. S. Standard bolts are used, to make the machine or nut taps with threads which are sharp at top, the essential points in which Mr. Bauer's system differs from those in common use being in the wide limit of variation in size of iron which it admits; in the fact that bolts are kept to the standard, the variation for fit and wear of taps being made in the nuts, so that by using taps adapted to the kind or class of work being done, the fit of bolts may be as desired, whether they be cut in the bolt cutter from rough iron, by dies in the screw machine on previously finished stock, or in the lathe.

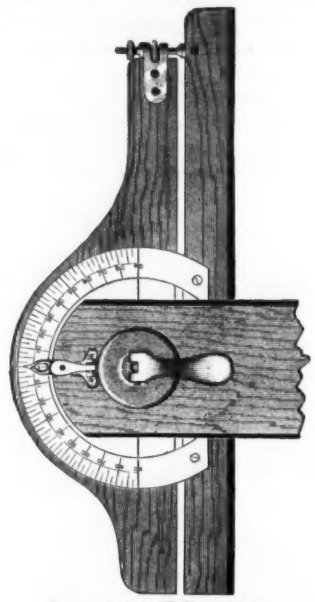
Jointing Machine with Slotted Head.

Our illustration represents a woodworker in which the tables are each mounted upon a horizontal slide which is moved by a hand-wheel to or from the cutter head, and can be clamped by bolts which engage with T-slots. In addition to this, the tables are fitted with inclined slides which are moved by the inclined screws at either end of the machine, the combination of the two movements making it possible to get any desired adjustment to suit the cutters or the work to be done. The two boxes are joined together in such a way that it is impossible for them to get out of line, and all working parts are thoroughly protected. A chute is provided, which receives and conducts away all chips, this being arranged for convenient attachment to the exhaust fan pipes. The machine has all the usual conveniences for doing such work as it is designed for, and is very substantially constructed. It is built by D. F. Walker, Philadelphia, Pa.



JOINTING MACHINE WITH SLOTTED HEAD.

The story of the first iron ship is told by Mr. Lindsay in his work on "History of Merchant Shipping and Ancient Commerce." He writes, "A steam vessel was for the first time fitted into a vessel of iron; she was named the Aaron Manby, and was constructed at the Horseley Company's Works for the joint account of Mr. Manby and Captain Napier—afterward Sir Charles Napier." Mr. Grantham, in his work on ship-building, describes an iron canal vessel built by a Mr. Wilkinson, of Bradley Forge, near Bilston, about the year 1787, and this is believed to be an early instance of a really working commercial vessel built of iron; and again in 1815 Thomas Jevons launched a small iron boat on the Mersey. She was built by Joshua Horton, near Birmingham, and fitted up at Liverpool, and is credited with being the first iron boat that floated on salt water.



IMPROVED T SQUARE.

An Improved T-Square.

We illustrate herewith an improvement in draftsman's T-squares, by means of which not only can any desired angle be laid off, but the square can be adjusted exactly to place after being set approximately by hand and clamped. For this purpose the adjusting nuts at the upper end of the head are used, the auxiliary head being turned by them upon a center which coincides with the main stud. By this means a very fine adjustment is readily obtained. The blade is clamped to place by an eccentric lever instead of a milled nut.

The pointer or index for the graduations of the protractor is also adjustable by means of the small set-screws seen at either side of it, this adjustment permitting the blade to be brought into a position to coincide with any previously drawn line, or to compensate for an inaccurate drawing board, and the index can then be brought to zero. The many uses to which these features can be put will readily suggest themselves to draftsmen.

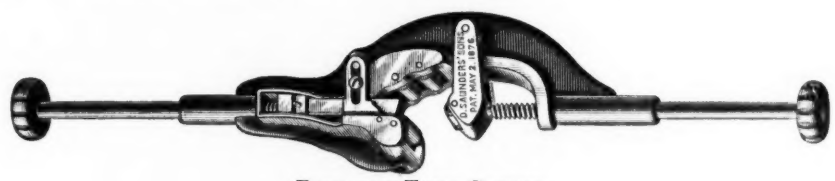
The squares are made by E. L. Deane, Holyoke, Mass.

Pipe and Tube Cutter.

A short time since there was some criticism of pipe cutters in these columns, because they usually leave such a burr inside the pipe as to prevent the thorough drainage of horizontal lines of pipe, so that injurious rusting took place at the bottom of the pipe near each joint.

In this connection Messrs. D. Saunders' Sons, Yonkers, N. Y., call attention to a pipe cutter which has been made by them for years, and which is not open to this objection, as it cuts off the pipe by removing a chip, the same as would be done in a lathe.

The illustration shows the latest improved form of this tool, and it will be seen that the pipe is held between a series of rollers which are closed upon it, after which the cut off tool is fed in and cuts the pipe off neatly and squarely, and without raising a burr that is at all objectionable. One of the rollers is provided with a small V near each end, which cuts a corresponding V in the pipe which it follows, thus preventing the tool from moving endwise on the pipe. It is equally well adapted to any pipe or tube of iron, steel or brass, or may be used for cutting off solid round bars.



PIPE AND TUBE CUTTER.

Postmaster-General Wanamaker sees no reason why mail trains should not be run between New York and Chicago in 15 hours. There probably is only one reason in the world; that is, the distance is too great for the time.

Rubber Pattern Work.

MOLDS AND FACE PATTERNS, PLASTER, ETC.

In making ornamental "face and preliminary patterns," where the figure or figures forming the design are to be carved in relief, much time and labor may frequently be saved, if, when making the blank (the base upon which the face or preliminary pattern is to be made or formed), an additional amount of stock is removed from the face of the blank equal to the depth of the figure or figures in relief, and afterwards making or forming the figure or figures of the design as follows:

Figs. 21 and 22, page 4, show front and sectional views of two base plate patterns for an interior shutter latch (connected by a gate). To make a face pattern for these from which the molds are to be made for producing the patterns in rubber, a blank can be made the same as Figs. 23 and 24 (which show top and side views of the plaster blank ready for the design figures to be formed or placed thereon). The figures of the design are then made or formed as follows:

Take a piece of sheet wax, the thickness of which equals the depth of the figures in relief, and large enough to cover the faces *a a′* and *b b′* of the blank, Figs. 23 and 24. Slightly warm the wax and lay it either on the faces of the blank marked *a a′* and *b b′*, Figs. 23 and 24, or upon any level surface. A drawing of the design figures may then be made either in the ordinary way on the wax, or by placing the drawing on the wax and then using a fine tracer to go over the drawing with, thus transferring the drawing to the surface of the wax. A sharp bladed instrument, such as a sharp-bladed pen-knife, or a similar instrument, can now be used to cut through the wax, following the lines of the drawing and (occasionally warming the instrument to facilitate the cutting of the wax) the intermediate portions or pieces of the wax between the figures of the design proper may then be removed; the figures can now be tacked to the blank in the manner already explained.

When the figures forming the design are in different degrees of relief in the various parts of the same, the sheet wax may be used in layers of the same or of different thicknesses, according to the height or depth of each particular part or figure (in relief) in the design; it will then be found much easier to cut through the wax in layers as required, to remove the intervening parts where necessary, than to carve away the same. When the figure or figures have been cut out or formed separate from the blank they can, when finished, be placed in their relative positions on the blank and tacked there.

The screw and rivet holes can be either made on the face patterns or they can be drilled and countersunk in the rubber patterns after the latter are made, as preferred.

Before pouring an impression of this face pattern, three dowel points or holes, which serve the same purpose (guide points for locating the two halves of the impressions or molds together in their relative positions), marked *c c′ c″*, are to be made at as many convenient points at about ¼″ from the outer margin of the face pattern proper. Other forms of guide pieces, grooves or points may be used if preferred, the object being to merely locate each half of the mold with the counter or opposite half of the mold, as mentioned above.

The plaster surface of the face pattern can now be carefully shellaced and an impression poured of the same. (Where the terms an impression can now be taken, poured or run, are used, the proceeding should in every instance be the same as already described for taking an impression of the face pattern for the "door-knob pattern," Fig. 19 *a*.) When the impression has been opened or separated the preliminary pattern can be completed by taking two pieces of sheet wax of the required thickness and placing them over the design figures on the inside of the impression and leveling the wax off to the thickness it is desired the body of the preliminary patterns should be. The flanges around the outer edges are then formed by cutting off narrow strips of the sheet wax and placing them around the outer margins of the preliminary patterns, or forming them otherwise as desired, after which the plaster surface may be shellaced, and, when dry, coated with soap water, or oiled with lard oil very thinly, to insure an easy separation when an impres-

sion or counter mold is poured or made of the same. As the impression upon or in which the preliminary patterns have been completed is to be subsequently used as a part of the mold in which the first rubber pattern is to be made, it must not be soaked prior to pouring the counter impression or half mold mentioned above. The soap water or oil will be sufficient to insure an easy separation of the impression in every case similar to the above, but it may be stated here that the soap water should not be used upon any part of an impression, cast, face pattern, or preliminary pattern when it is necessary to have the same present a smooth surface on the counter impression after the same has been poured and separated; for wherever the soap water has been used the surface on the counter impression will, when opened or separated, in most cases present a rough and often a spongy appearance, which makes it unfit to be used as a mold, cast or impression, as the case may be. At the same time soap water will be found to be the best coating for use in connection with or without shellacing the plaster surface other than that portion of the plaster surface which is to form a part of or the whole of an impression, cast or mold, and it can therefore be used with the certainty of an easy separation on such surfaces as do not require to be perfectly smooth, and the time spent waiting for the shellac to dry (when shellac has been used) is therefore saved, as the plaster surface or surfaces mentioned above can, when coated with soap water, be poured immediately afterwards.

It is assumed that the plainer or simpler forms of patterns used in every-day practice will need no explanation here, or rather the methods of making the preliminary patterns and molds for producing the same, as the foregoing examples given are considered sufficient to convey a general idea as to how preliminary patterns and molds may be made with plaster or wax, etc.

Rubber patterns may be made in plaster molds, the preliminary patterns and molds being made in precisely the same way or manner as described for making the mold patterns from which the duplicate metal molds are to be made, using the plaster molds instead of the metal duplicates. The plaster molds must, however, be inverted in metal flasks before the rubber patterns are made therein, the principle involved being exactly the same as molding in sand or loam, plaster being used instead of sand or loam for making the molds.

Blank patterns can be made in rubber if preferred and afterwards finished, and the design (if any) carved thereon, without making a preliminary pattern in most cases, by making the molds in which the blank is to be made, instead of making a preliminary pattern and then making the subsequent molds from the first pattern produced. For instance, a rubber blank could be made for the door knob pattern, Figs. 17 and 18, by making the molds like the inner surface mold, Fig. 20, and an outer surface mold like Fig. 25, which shows half-sectional view of a plaster blank mold, the two when placed together forming the mold complete, ready to be invested in the flask. Vulcanized rubber in sheets or blocks may also be used for making patterns, the rubber being worked in the same manner as wood in such cases, or for such articles as the interior shutter latch, Figs. 21 and 22, and also for a large variety of plain designs. As there is no grain to the vulcanized rubber it may be cut or filed with the same facility in all directions.

SHELL PATTERNS.

In making hard rubber patterns in plaster molds where the body of the pattern or any portion of the same would of necessity be more than $\frac{1}{8}$" in thickness, it will be found necessary, for reasons which will be hereinafter given, to so arrange the molds as to produce a shell pattern, which may be done by coring or by using the bulbous system, which will also be fully explained later on in these articles.

When cores are used the plaster must be mixed with some carbonate of lime, such as whiting, chalk, or marble dust, in such proportions as to allow of the carbonate of lime being readily dissolved in acid (after the patterns have been vulcanized), to remove the cores, as the gypsum (or plaster of paris that has been mixed by the addition of water) is in itself insoluble, no solvent being known for gypsum, even amongst chemists. I might add, however, that I was recently fortunate enough to discover that gypsum is soluble in a strong solution of the carbonate of soda (commonly known as sal or washing soda), the exact proportions of which I made no attempt to ascertain, as I found that the action of the carbonate of soda as a solvent for the plaster (gypsum) cores, was too slow to be of any practical value for the above-mentioned purpose. I have used a mixture of half plaster and half whiting for making the cores, and found when the patterns were immersed in muriatic or sulphuric acid that the whiting dissolves very quickly, leaving the plaster as a precipitate, which can be very easily washed out with water without in any way injuring the patterns.

I will give one example only of shell pattern work, which will be sufficient to illustrate the principle and method involved.

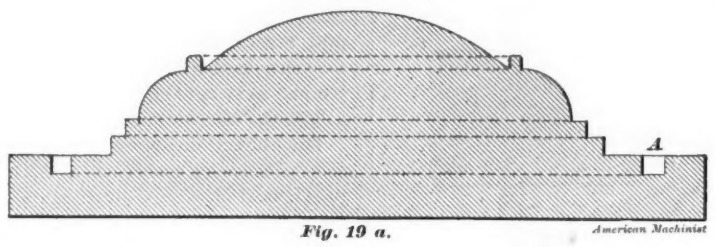


Fig. 19 a.

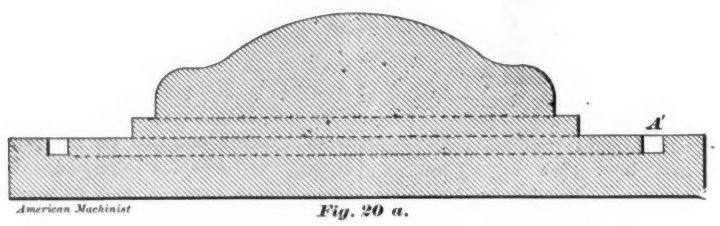


Fig. 20 a.

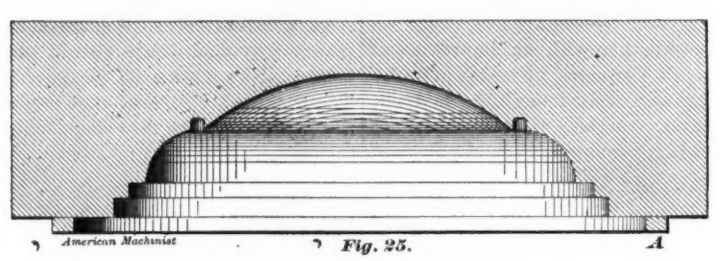


Fig. 25.

Fig. 21.

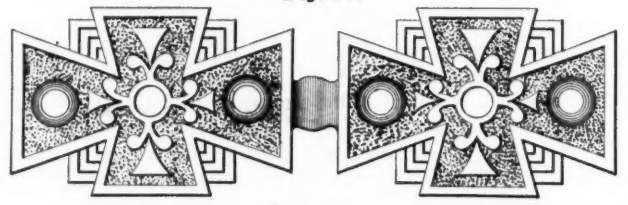


Fig. 22.

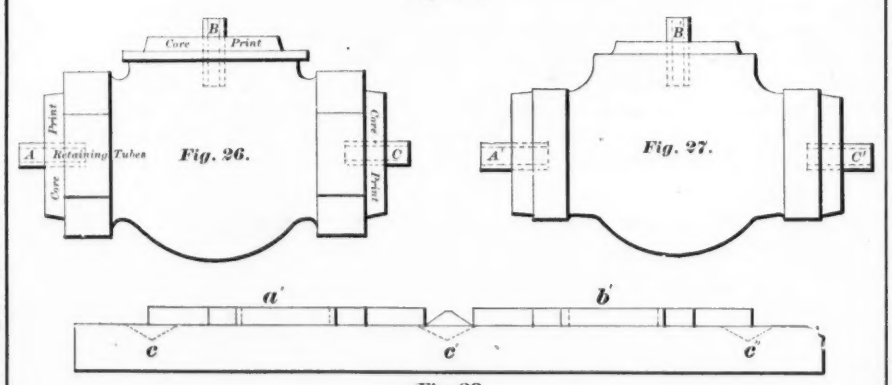


Fig. 26. Fig. 27.

Fig. 23.

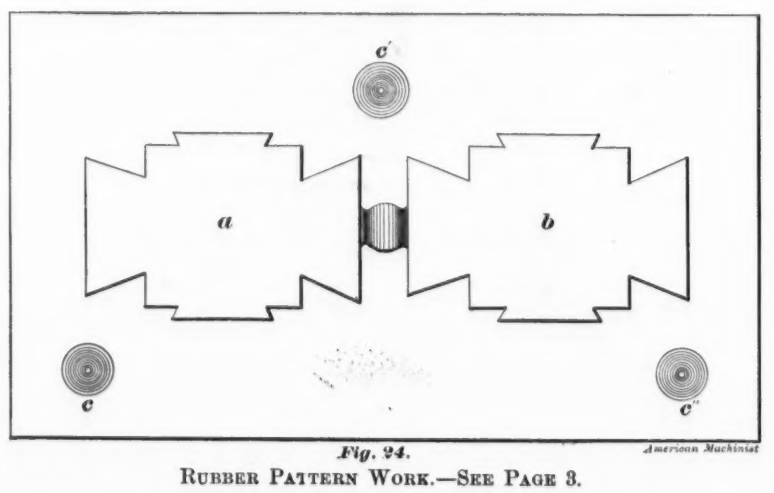


Fig. 24.

RUBBER PATTERN WORK.—SEE PAGE 3.

Figs. 26 and 27 show outline drawings of rubber patterns and plaster core (with retaining tubes imbedded therein) of a valve box or casing for a globe or a check valve.

The pattern can be made $\frac{1}{16}$" in thickness, which will in all cases be found ample enough for strength, etc.; a core can be made $\frac{1}{8}$" less (all over) than the outside measurement of the pattern, with (in this case) three retaining tubes *A A'*, *B B'*, *C C'*, Figs. 26 and 27, inserted therein at the points shown on drawings. These pieces of tubing are $\frac{1}{4}$" internal diameter and of any length desired, and are intended to serve the purpose of locating the core in a central position in the mold and retaining it there during the process of vulcanizing the rubber pattern, and subsequently, to allow of an ingress being made to the core through the tubes, to remove the cores with acids or otherwise. In making the cores it will not be necessary in every instance to produce all the details of the form of the pattern proper (in the core); the corners or prominences, or a part of the same, may be omitted at the discretion of the workman, unless it is desired to make several of the patterns in the same way, when a core box can be made for making the cores in, with channels for locating the retaining tubes in the cores in the same.

A preliminary pattern may be made or formed on the core (if no other pattern is available) with wax or other material, as preferred, and the mold, in which the first rubber pattern is to be made, made from that, the first rubber pattern produced being afterwards used for making all subsequent molds.

If the patterns are to be attached to a "card" the patterns must be split (made in halves), and instead of making a whole valve box pattern it would only be necessary to make a pattern (preliminary) for one-half of the valve box, which would in this case be a duplicate of the other half on being inverted. The half patterns may still be made as shell patterns, provision, however, being made for doweling the halves together and connecting them with screws where required by forming ribs on the inside of the pattern at any and as many points as desired, for the above-mentioned "dowel pins" and "screws" to pass through and into the same, said ribs not to exceed $\frac{1}{8}$" above the diameter of the above-mentioned "dowel pins" and "screws." It will not be necessary to make or use any cores in making the half shell patterns mentioned above; a face pattern showing one-half of the external surface only need be made, and when finished an impression or half mold made or poured (as explained for the preceding examples), and when separated the half shell pattern may be completed by forming the internal part or surface (including the above-mentioned ribs) in the same manner as explained for completing the interior "shutter latch," Figs. 21, 22, 23 and 24, with wax on the inside of the impression or half mold mentioned above.

In place of the retaining tubes inserted in the plaster cores for making shell patterns, pieces of wire or iron may be used if preferred, and if the ends of the same (inside the core) have not been bent or flattened, they can be very readily withdrawn from the rubber patterns (after the latter have been vulcanized) by heating the ends of the wire which protrude through the pattern and then grasping the ends of the same with a pair of pincers, and pulling them out.

In your issue of March 17, Figs. 19*a* and 20*a*, here given, should have been used in place of Figs. 19 and 20.

"I remember a big fellow," said the railroad man, starting in at once, "whom I hired once here in Texas to travel about for our road when we were having some trouble among the employes. There was a disturbance at one of the stations one night over a scab who was trying to pull out a freight train. The strikers were very ugly and began firing. My big fellow faced the leaden hail until the engine and train were under headway, and all were soon out of sight. That evening he walked into my office and asked for his pay, and in reply to a question he said: 'I faced the bullets; I ain't afraid of guns, but when it comes to ridin' behind a crazy engineer, and a scab at that, who was going at the rate of seventy-five miles an hour, I object.' I told him that wasn't such very rapid traveling under the circumstances. 'I know it,' he said. 'I didn't

object to that so much, but when he began to jump the curves that unnerved me and I left the engine while he was in the act of doing the latter.' There were engineers in Texas in those days who used to jump the curves when they were behind."—*Chicago Tribune.*

Universal Combined Punching and Shearing Machine.

In the accompanying illustrations, Fig. 1 shows a combined power punching and shearing machine. It is an exceedingly handy machine, and well adapted for the work it has to do. Its novel and advantageous feature is the arrangement of the knives for cutting bar, angle, tee and other forms of iron or steel.

The movable knife is held in a recess in the side of the slide, and the stationary one is held by a corresponding recess in the head. The stock to be cut is passed through a circular transverse aperture shown above the punches in the illustration. The knives are exact duplicates of each other, and they are therefore interchangeable; both are placed into position through a slot cut in the front of the head, and are held in position by two sliding pins shown on the side of the machine. When it is desirable to change the knives the two sliding pins are drawn a short distance outward, the required knives are entered through the slot in the front of the head and pushed into position, shoving those previously used into the recess shown at the rear of the head; this completes the whole operation of changing the knives and puts the machine in a condition for cutting. The knives in the recess can at any time be easily removed, but if desirable they may be left there, as they are not in the way. There are no bolts or screws used for securing the knives; it requires no experience and scarcely any labor to place them into position, and the loss of time in changing them is comparatively small.

The construction of the knives is such as to reduce their liability of becoming dull, and with the aid of the bushings placed in transverse apertures at each side of the knives a clean square cut can always be obtained.

Punches are fitted to the bottom of the slide as shown in the illustration, and these in no wise interfere with the cutting-off arrangement above. If desirable, these can be replaced by shear blades for shearing plates, or by dies for pressing sheet iron into all kinds of ornamental work.

This machine weighs about 10,600 pounds; it is capable of punching 1-inch holes through 1-inch plates; will cut plates 1 inch in thickness, round iron up to 2¼ inches diameter, 2-inch square iron, and angle, tee and profile iron up to 4½x½ inch.

Fig. 2 shows a hand-power punching and shearing machine, in which the same principles of construction are involved. It is very powerful and does excellent work. Three sizes of this design are built; the smallest weighs 290 pounds and is capable of cutting angle, tee and profile iron up to 1½x¼ inch, and all sizes of bar-iron up to ⅝ inch diameter, or ¾ inch square. The bottom of the slide may also be arranged to shear plates up to ⅜ inch in thickness.

Hugo E. Stolpe, 154—156 West Twenty-seventh street, New York, where one of the machines may be seen in operation, is the patentee; Messrs. Watson & Stillman, 204–210 East Forty-third street, New York, are the manufacturers and agents.

The New York Central Railroad Company will soon begin work on the new bridge across the Harlem River. The bridge and its approaches will cost about one million dollars. It will be a drawbridge, made of iron and steel.

So far, fifty-nine foreign nations have signified the intention of participating in the World's Fair.

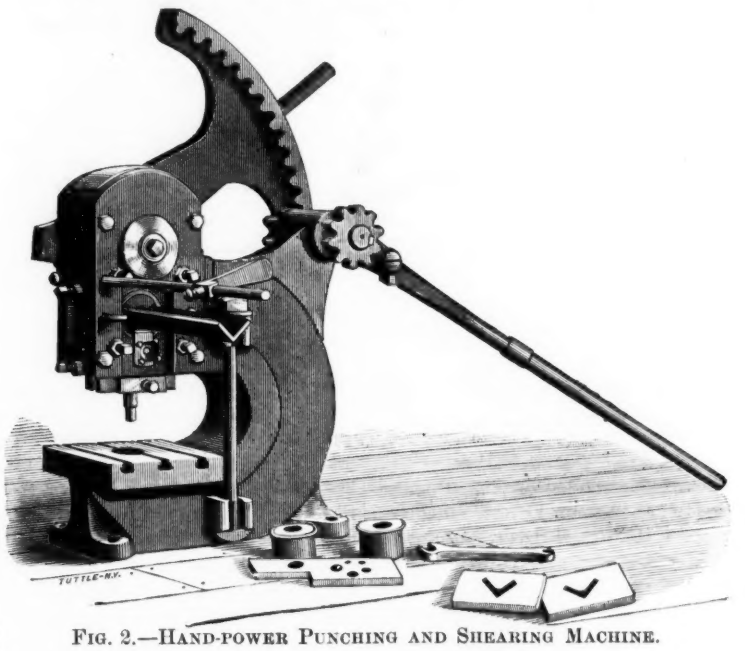


FIG. 2.—HAND-POWER PUNCHING AND SHEARING MACHINE.

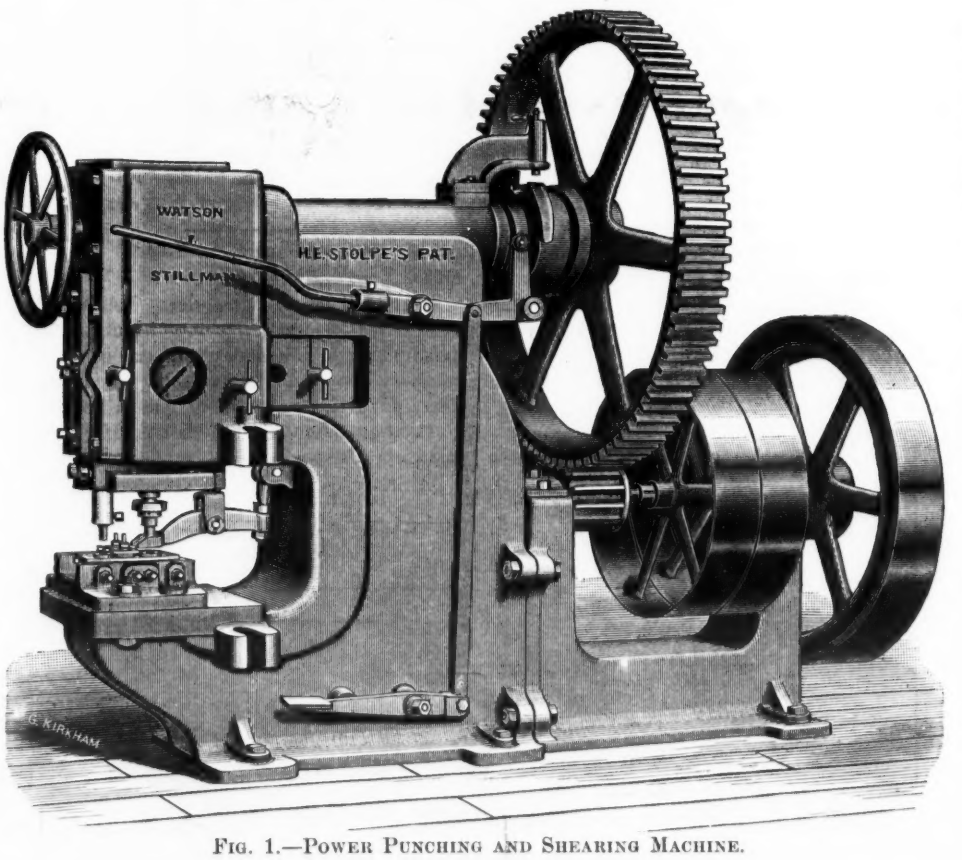


FIG. 1.—POWER PUNCHING AND SHEARING MACHINE.

LETTERS FROM PRACTICAL MEN.

Correct Piping to Indicators.

Editor American Machinist:

Every few years a question of moment to the engineer is presented, thoroughly discussed through the medium of scientific and trade papers, then allowed to remain quiet for say five years, when some one stirs it up again, and the battle is fought over by the pros and cons with as much fierceness as though it had never before been brought to the surface, and while we old fellows look on, a queer combination of emotions possess us. We note that a new generation has stepped on the boards, that is destined to crowd us off, and we want to make the path easier for them than it has been for many of us; therefore, whenever a question is under discussion in which our experience may be of service as showing what has been done, it seems to the writer worthy of record. As a preface to what I am about to relate, some twenty-five years since I acquired some reputation as a manipulator of the steam engine indicator. Among other duties I was engineer of a large mill. One day while at the mill our manager brought to the engineer's department as a visitor a well-known writer on mechanical subjects. The engine was duly admired by the visitor, and in due time indicator cards were called for and duly admired; "correct admission," "correct steam line," "correct expansion," "release right," "vacuum line good," "compression excellent," etc. Couldn't visitor be spared a set of cards? "Certainly!" And without any thought except to select a card from each end that was not unduly finger-marked, I selected one from the crank end that showed a load about forty per cent. more than the one from the head end.

A few days after this visit the manager wanted "permission" for two well-known experts to take some cards for the previous visitor, who wanted to incorporate them in a magazine article. In due time the experts (one of whom I knew) entered the engine room. By a process of pumping I learned that our first visitor had noted how the engine was piped for the indicator, and had jumped to the conclusion that it was wrong, and the cards he had obtained were proof positive. Therefore if he could get a set of cards taken by his men, showing the error, while it might be bad for some one, it would be glory for him.

I then insisted that a thorough test should be made, that this question might be settled forever, so far as the experts and the engineer were concerned. The engine was a 26 x60, making sixty revolutions per minute. Close to each end of the cylinder were straightway cocks, outside of which, connected by short nipples, were tees looking toward each other, connected by half-inch pipe midway on cylinder with a three-way cock on which the indicator was usually placed to take cards from both ends; but connected to the first tees at each end of the cylinder were also placed attachments for indicators. Cards taken from crank end with indicator at direct short connection and at the three-way cock at the same instant showed no difference; that is, we could none of us detect any difference. The same was true of the head end of cylinder. Then by taking off my three-way cock, connecting by straight pipe and shutting off the cock at crank end of cylinder, we were enabled to take cards at the same instant from the head end onto the first indicator connected by short pipe to the head end, and also from the indicator placed at crank end of cylinder. Even here, though, the steam had to travel some 5½ feet more in one case than in the other, and had to twist through two ¼" tees, yet no difference in the cards could be detected.

Later on we made a tee connection for the indicator at the center of cylinder, in place of the three-way cock; then by closing the cock at crank end we could take cards from indicator placed midway on cylinder and at head end simultaneously, and then there was a decided difference.

Now this experience taught me two things: first, never try to build myself up at some other fellow's expense; second, the *way* in which an indicator is connected amounts to more than the length of pipe with which it is connected; and I trust some of our friends who are at present discussing this question will see the point.

W. H. ODELL.

Pitting in Boilers.

Editor American Machinist:

In your issue of April 7, Question 149 relates to pitting in mud drum. It is probable that the pitting was deeper and worse in the mud drum than elsewhere, and for this reason the inspector suggested its removal.

While I know nothing of the conditions of the case cited, yet, in a broad way, pitting is more severe in the mud drum than in any other one part of a boiler. One case came to my attention recently, in which the boiler, including tubes, heads and braces, was free from any pitting, while the drum was plainly marked. The boiler and drum were new—in use only three months. This indicated the tendency of the pitting to attack the mud drum first, and, as in the majority of cases, to do the worst there.

Boilers used for steam heating and using the returns, and supposed to have the least trouble with scale, may have a more serious evil in pitting, and may not. In a boiler of this service it may be a good plan to have some scale, but a better way, perhaps, would be to change water.

The fact is that pitting can and does act under scale, and in some cases its presence is unknown until the boiler is scaled. Several cases of this kind I have recently met with and investigated. In one case (in Indiana) the tubes were covered with scale ⅛" thick and scraping off the scale revealed the tubes pitted. The pits were filled with black dead iron that the point of a penknife easily picked out, leaving the irregularly-shaped hole of the pit with a depth of $\frac{1}{16}$".

In some cases pitting may be plainly seen by the bright red marks over the parts affected, showing vividly on the gray background of scale. Others may show through scale formation as small lumps. Scraping to the bright iron will reveal the pitting directly under the lump, and the contents of pit is often found to be a black powder-like substance.

In one instance the braces and tubes were badly pitted, while the shell and heads were free. The braces were worst at the back end, and were as badly marked above as below the water line. These boilers were used for steam heating, and the returns were direct to the boilers. No mud drums were used.

Many theories are advanced concerning the cause of pitting, but few, if any of these, will apply to the many variations of the trouble, and account for the singular and apparently capricious manner of its attacks.

The theories run through the usual list, viz., galvanic action, vegetable matter, cylinder oils, acting through open exhaust heaters, bad boiler compounds, pure water, etc. The first-named may or may not be the cause; it is, however, a very popular theory, largely, perhaps, because of it being a convenient one when you can't figure out a better.

Vegetable matter will account nicely in some cases, but in the major number the vegetable theory will lay off when needed. The cylinder lubricant of the past was tallow, and the engineers of that period may have started that theory with good foundation, but with the oils in use to-day, with the many open exhaust heaters in active service, any theory charging pitting to this cause would utterly and ingloriously fall to the ground.

The pure water theory has many proofs, and yet cases are on record where the use of just as pure water does not pit either an iron or steel boiler. Even admitting the truth of it, how shall we account for its inaction in other cases under similar conditions?

I have no theory to offer to explain the cause of pitting, or any specific for its prevention. It demands a careful investigation for each individual case. An analysis of the feed water may be of value in locating the cause, but in some cases even this has failed.

T. T. PARKER.

Printing Press Cylinders.

Editor American Machinist:

I would say in reply to MR. Templin's letter in your issue of March 31 that if he will *carefully* read the articles and correspondence on the above subject that have appeared in the AMERICAN MACHINIST, he will find his first and second questions are out of order, and the third answered.

The fourth: How to secure the cores in order to elevate your flask on end to pour it, is an easy one, and perhaps that is the reason why I can answer it. I suppose it is the slot cores which trouble Mr. Templin.

I believe they are usually secured with nails or wire; sometimes they are pasted in with a little flour and water, which molders call paste. That seems very simple.

The difficulty of molding these cylinders on their side, securing the cores and turning on end, is imaginary. There are any number of cylinders other than printing press cylinders molded on side and turned on end, where it is much more difficult to secure the cores than in any printing press cylinder ever made or likely to be made.

We have this last two weeks turned out two large slide valve cylinders, with double steam chests and feet cast on, which were molded on side and turned on end for casting. There were a number of large and complicated cores to set and secure, but it was done without any one expressing amazement at such an every-day kind of a job.

I will not quarrel with Mr. Templin as to who has had the largest amount of "experience" in making printing press cylinders. All I can say is that we have tried two methods, viz., the two in question, and prefer to make them from patterns made similar to that shown in the AMERICAN MACHINIST, September 17, 1891. Of course the illustrations given then were only sketches, and were not intended to represent an ideal printing press cylinder, but only to represent the making of them. This last explanation will perhaps satisfy Mr. Cummings.

P. S. DINGEY.

A Revolution Counter.

Editor American Machinist:

I notice an inquiry under your Questions and Answers, by J. W. R. (No. 163), in your issue of April 21st, asking for a simple way for getting the number of revolutions of a machine without using an indicator.

At one time I was called upon to determine the number of revolutions of an electric motor which was running at a pretty high speed, and having no revolution counter I was obliged to devise some way to make an accurate count, which I succeeded in doing in the following manner:

I first, by means of stout twine, bound a pencil on the end of the motor shaft, the sharp end pointing away from the machine, as shown in the sketch (Figs. 1 and 2). I next found a packing box and nailed a pair of guides on it, one on each cleat, as is shown in Figs. 3 and 4, and through these guides I slid a board which was smoothly planed all over, and on the front of this board I fastened a piece of paper.

My next step was to level up my box in front of my pencil so that the point just touched the paper and made a mark on it. The position of the shaft and pencil is shown at *S* in Fig. 3, and it will be understood that the plane of the paper is at right angles to the axis of the shaft, so that the pencil in revolving will describe a perfect circle on the paper.

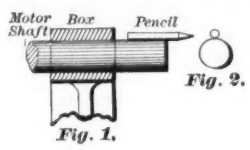


Fig. 1. Fig. 2.

The motor was then started and the board was moved in the direction of the arrow shown in Fig. 3, during a minute's time, the pencil describing a series of curves on the paper, and then the paper was taken off the board and the number of curves counted, which, of course, told the number of revolutions made during the time of moving the board, which, in the case referred to, were found to be about 700 turns in a minute.

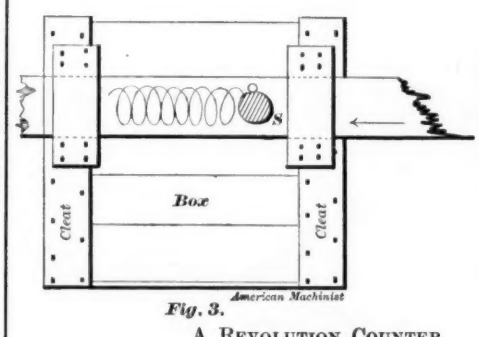


Fig. 3.

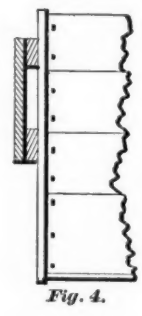


Fig. 4.

A REVOLUTION COUNTER.

Of course, care must be taken in setting the paper against the pencil, as, if there is too much friction, the point of the pencil will be worn away so rapidly that it will not mark during the latter part of the indication, and too soft a pencil must not be used; the one I used was a HHH made by A. W. Faber, and with it I had no trouble in getting some 3,500 curves at the first setting.

After a few trials it will be found that the board can be moved along at a very uniform rate by the hand, and no trouble will be found in counting exactly the number of revolutions on a shaft running, say, a thousand or fifteen hundred turns a minute.

This device can, of course, be easily elaborated, but it was only a cheap makeshift for me, and I hope it may be of service to some of your readers when they have no speed indicator at hand, and when they wish to count the revolutions of a shaft which cannot be counted in the old-fashioned way.

ALBERT A. CARY.

A Surface Gauge Attachment.

Editor American Machinist:

In reading the description by Mr. A. D. Pentz, of his remarkable surface gauge, in your issue of February 4th, the applicability of Mr. Wincock's plunger and index movement to the ordinary surface gauge occurred to me.

Working now and then in the few idle moments at my disposal, I sawed and filed from one end of a piece of steel $\frac{3}{8}'' \times \frac{3}{8}'' \times 4\frac{1}{2}''$, leaving the projection *A;* this was drilled and slotted, to receive the fulcrum pin *F* and head of the index *B'*.

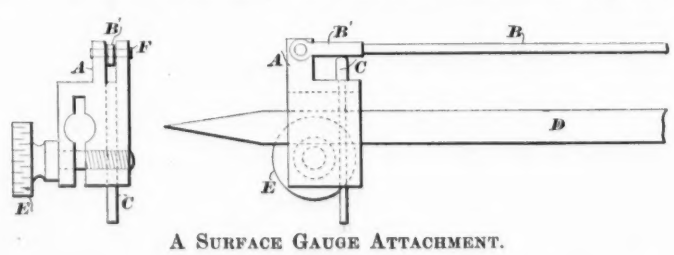
The plunger *C*, I made of steel, with a large head to prevent its slipping through the hole that it easily slides in, and which is directly in front of the slot and $\frac{3}{16}''$ from the center of the fulcrum pin, this with a 7" index would make an adjustment to .001" quite an easy matter.

A hole was now drilled, the size of the gauge arm *D*, parallel to the slot and $\frac{1}{4}''$ from the top. To bind the attachment to the gauge arm *D*, I slotted the piece to within $\frac{3}{32}''$ of the top through the center of the hole, drilled and counterbored a hole for the binding screw *E*, which slipped through the thinner and screwed into the thicker side of the slot.

The index was made of aluminum wire, though a small steel wire would have answered the purpose about as well. I found it advantageous to make it as light as possible; its head is of steel drilled for the fulcrum pin and carefully fitted in the slot.

I have since found it an invaluable auxiliary to the delicate adjustment of the gauge; in fact, its innumerable uses and advantages for most work, over the ordinary rigid joint of the gauge arm, is so apparent to every mechanic that no clearer demonstration appears to be necessary.

F. L. HAVILAND.



A SURFACE GAUGE ATTACHMENT.

Packing for Water Glasses.

Editor American Machinist:

As I have very often been assisted by your Letters from Practical Men, I thought I would send a little of my experience, hoping that it may be of value to some one.

In using the rubber rings that are furnished for the purpose of packing water glasses on my boiler, I have had them wear thin and break very often. About two years ago I began to use asbestos lamp-wick, well soaked in plumbago and oil, since which time I have not had one glass break.

I use the same on my sight-feed lubricator glasses, and they are always tight, and no leakage at all in two years.

No more rubber rings for me.

VETERAN.

"American Boasting."

Editor American Machinist:

In his article on "American Boasting," Prof. Sweet demonstrates very conclusively that because one horse working one day can not do as much as twelve horses working thirty days, therefore that one horse is not much of an animal to brag about. It is true that the Professor does not put it in just this form, but the result is the same. He mentions the principal acheivements of twelve different countries, the date of some of which goes back thirty centuries into the past, and then argues that because some particular people, in some particular age, have done some particular things better than the American people are doing them to-day, we have no grounds upon which to be boastful about anything.

This argument is somewhat new to me, but I can readily see the force of it. The next time my wife wants a new Easter bonnet I will proceed to demonstrate to her that because one bullfinch cannot raise as many tail feathers as ten turkey buzzards, therefore a new Easter bonnet is a useless luxury, calculated only to take food out of the mouths of the hungry and create envy in the hearts of her neighbors.

The Professor tells us that we make watches, but adds that we should be humble, because when we want a really good watch we must go to England or Switzerland for it. It seems, however, that all of the rest of the world has also to go to one of these countries for good watches, and consequently we are not the only people who should humble ourselves into the dust before those which are greater. From a further study of the subject it seems that England and Switzerland must go to India and China for their silks and ceramics, Japan for their lacquer work, France for their tapestry, Italy for their music, and various other countries for various other articles, and consequently these countries should be as humble as we poor Americans, who do hardly anything as well as other people. In fact, it is quite evident that no people anywhere on the face of the earth have any reason to be boastful about anything whatever. If this argument will have any effect in abating the somewhat pernicious practice of boasting, I will not quarrel with it.

It is quite true that the Swiss, the Germans, the French and a number of other people do finer work on certain classes of things than we do; but I wish to remind the Professor that there is something finer than finely finished engines and machine tools, something more difficult to make than hardened steel turrets, and something more delicate than the making and the adjustment of the finest Swiss watches, and all of the world has to come to America for it. I refer to those great telescope glasses made by Alvin Clark—lenses so perfect in finish and form that they cause unknown stars to stand out on the blue vault of heaven like drops of sweat on a fat man's brow.

Professor Sweet seems to be of the opinion that the more accurately a thing is made, and the more finely it is finished, the better it is. Many people differ from him on this point, on the ground that adaptability to circumstances, and not fine workmanship, is the true measure of quality. I have heard of railroad spikes being made of gold, and while I never saw one, I have no doubt but they were much more carefully finished than those in common use in foreign countries; but I doubt if they were any more valuable as *spikes*. No one doubts our ability to polish and nickel-plate *all* railroad spikes; but if we should do so it could hardly be expected that many foreign countries would give us much credit for superiority in the spike business.

Perhaps other countries saw lumber better and with much less waste than we do. Band saws with blades made from Waterbury watch springs would probably saw still finer and with still less waste; but it must not be expected that tools of this kind would get much patronage in the lumber camps of Michigan, Washington and Oregon, where timber is cheap and labor is dear.

Professor Sweet takes the wind out of our sails by stating that our most gigantic structures are eclipsed by those of the old world. Perhaps so; but is mere size a matter about which any one can justly be boastful? I do not remember the dimensions of the Machinery Palace in Paris, but we have a building now going up in Chicago that is 1,687 feet long, 800 feet wide, and has a clear internal span of 390 feet. No one doubts the ability of our engineers, or the engineers of any one of a dozen or more other countries, to construct larger buildings, longer bridges, heavier guns and more powerful warships than have yet been constructed when the money is forthcoming; and the money is on hand to be had when the necessity occurs. There are thousands of men who are ready to say: Furnish us the money and we will build you a monument larger and more enduring than the pyramids of Egypt.

But why brag about such things? In fact, why brag at all? As Prof. Sweet says, it certainly is in bad taste and does us no good. It is highly proper, though, that we make comparisons, comparisons that are just, fair and equitable, that we may know just where we stand in comparison to the rest of the world, and thus learn how to improve ourselves.

Prof. Sweet says that we have not produced as many great men or men of such transcendent greatness as have been produced by these other twelve countries in the

past thirty centuries. Quite true. Counting from the Declaration of Independence, this country has been in existence only a little over 100 years, yet we have produced a few men, like Noah Webster and Thomas A. Edison, who have been pre-eminent in certain lines. Give us the other 35,884 years in which to produce great men and accomplish great results, and if at the end of that time we have not had as many great men, and as many great achievements placed to our credit, as have already been placed to the credit of the past, then it may be truly said that Americans are not up to the average, and have little about which they may be proud.

C. L. REDFIELD.

Mechanics and Machines.

Editor American Machinist:

In the AMERICAN MACHINIST of March 24th I saw an editorial under the above heading in which I was considerably interested. I believe that machines do not make mechanics any less skillful or rob them of any "glory." The real mechanic of to-day is a better one than ever before when he is seen in his real light. The trouble is that many people do not consider him in his right light. I understand that many years ago all the nails that were used in buildings were forged by a hand process; that there were men who worked all their lifetime making nails in just the same way that their fathers and grandfathers had done. These men were called mechanics, and I would like to inquire how such a man would compare with a mechanic of to day, who can design and construct a machine for making nails that will make more in one minute than the old-time fellow could in a whole day. The *machinist's* trade is not growing less, but only changing. The methods in use to-day are more scientific than those of twenty-five years ago. I claim that a man who can handle planers, and get out good work of a great variety reasonably quick and cheap, is a more skillful mechanic than the old fellow who would chip and file a lathe bed as he used to do it.

Some people have a very faint idea of the amount of skill required to handle all branches of the machinist's trade of to-day; like the boy who, when he has succeeded in running a chip across a piece that the "boss" showed him just how to put onto the planer and start, believes he knows all about the business, when really his ailment is a combination of conceit and ignorance. I am proud to live in an age of progress like this; but there are some things connected with modern methods that I am not so proud of. By the use of so much machinery, work of all kinds is being done on a larger scale than ever before. The circumstances of the case make this a necessity. Machinery is expensive to make and run. The old-time nail maker cannot to-day purchase the proper machines for a nail works, for anything near what his old shop and tools cost, so he cannot now be the proprietor of a shop, but instead must be an employe. This is an age of fewer proprietors and more employes, but this is not what I am "kicking" about—this is a necessity of the times, and I do not want to butt my head to pieces against a stone wall.

What I really do want to call attention to is the fact that the relations between employer and employe in regard to fair usage of each other are about the same now as when the cases of each were much different. In old times, on account of the little expense of starting a business for one's self, if an employe was dissatisfied with his treatment then all he had to do was to start for himself, but to-day the great mass of people are forced to be employes, so there is need of the general government making laws and enforcing them, to compel fairness between employer and employes. When I say *fairness* I mean just what I say, and no more.

A law and a penalty to enforce fairness does not apply to anybody who is acting in a fair manner. I believe it is a fact that anybody who has the means and the inclination can carry on a legitimate business; so is it anything to be wondered at that sometimes a man may get into a manufacturing business, who, if he had lived a few hundred years ago, would have been the captain of a pirate ship and have been hanged for it? Now who is there who will say that such a pirate will be fair and honest when left to his own inclination?

I say that a dishonest person is just as liable to be at the head of a manufacturing concern as in anything else. One of the most staring evils that I have in mind just now, and one that I believe a law could be made to work upon in a satisfactory manner, is the practice of furnishing employment at wages that will not buy a living. It is the result of blind, dishonest, unguided competition—a law that would use every employer alike would help the matter much. It is surprising how cheap some things can be bought. I like to buy things cheap just as well as anybody when I know that the low price is caused by the use of machinery and improvements in methods, but I do not want to buy for a low price when I know that the difference represents the suffering of some poor mortal. To make the matter more plain I will say I found I could buy a good well-made shirt all ready to wear for $1 and less. I know that the trader who was so willing to sell me this had some object in doing so; that he made a good profit out of it, and that it was likely that one or two others had made a profit since it left the hands of the parties who made it. I inquired the cost of the material that went into this garment, and when I got through I was forced to believe that there was very little left for the maker. I have understood since then that a full-grown woman could make about 20 or 30 cents per day of 12 or 15 hours on such work. I do not know of anything in the line of machinery that has got to such a state yet, but would not be surprised if there was. As I said before, I am anxious to receive all the benefit possible from the use of machinery in every line, but I am willing to pay what is fair for human labor.

I just want to call attention to the fact that, along with all the good and great things brought about by the use of machinery, there are screws loose that are sadly in need of adjusting, and it would be a good thing if the parties who are best qualified for such work would try to distinguish themselves by adjusting them.

A MECHANIC.

Placing Valves.

Editor American Machinist:

I see a great deal of talk in the AMERICAN MACHINIST about placing valves on steam boilers. Saw-mill Engineer says that the "blow-down" ought to be placed so that the pressure comes on top, for fear that the stem might strip. How will he get his water out of the boiler, provided his valve stem strips in trying to open the valve with pressure on top? Open the bonnet and flood boiler-room is about the only way I see; or take out manhole and insert a hose, and start the pump. Any valve not capable of withstanding all necessary pressures should be discarded at once.

Every boiler should have a stop valve placed close to the boiler, and it should be independent of safety valve. It should be so placed that the pressure comes under the valve, especially where there is more than one boiler, for the following reasons: If we close down one boiler the pressure will then be reversed on the valve, insuring safety to men making repairs or cleaning. In the second place, valves are liable to drop from their stems, and if the pressure acts on top of the valve it will hold it down, and the factory, saw-mill, or electric light station must close until steam is all blown off before repairs can be made, and everything in order to start again.

WILLIAM KAVANAGH, Engineer.

The Breaking of Two Cylinder Rods.

Editor American Machinist:

In our mill recently we had a piston rod break. It was of the type known as the screwed rod, in a crosshead that has a threaded stud running through it that supports the shoes in the guides. It was made of steel, and the break was at the base of the thread, and showed an old crack of long standing that extended two thirds of the distance through the rod. It was on a 28" condensing engine, and it took the cylinder head out and cracked the end of the cylinder so badly that a new one was necessary.

The question is sometimes raised as to the superiority of steel over iron, some claiming that iron is the safer.

A few days after this occurred, the writer was standing at the depot in New Haven, and saw a train come in, drawn by an engine that had had the same experience, only this was a keyed rod, and had been cracked over three-quarters of the way off before the final break, and spots on the rod showed that the rod had worked sufficiently to make smooth spots on the break, and the small amount remaining also showed that the rod must have been very tough—much more so than on the 28" cylinder.

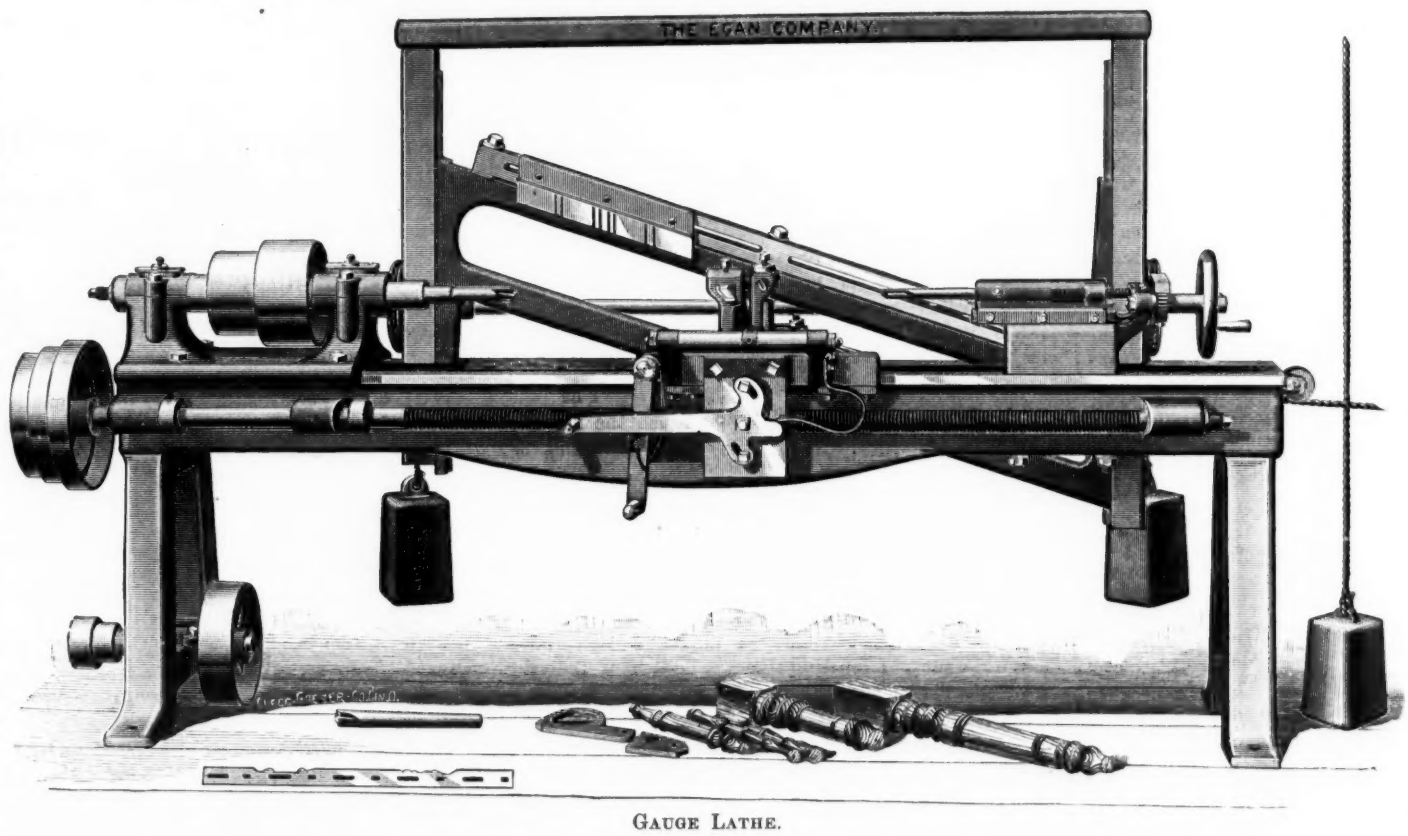
The question arises, Would these rods have had the initial crack if they had been of horseshoe scrap, properly piled?

There was one marked difference between the two breaks. On the 28" cylinder the bolts holding the head were taken off clean, all but one, and none of the cylinder head left, and the end of the cylinder so badly damaged that a new one had to be made.

On the locomotive, a part of the flange of the head remained; some of the bolts were taken off, but in no place that showed that the cylinder had received a severe strain, and it was in perfect condition.

It is the custom on many railroads to make the head weak, so that if the piston does come out, or it gets an extra charge of water, the head will go out without damaging anything else. On mill engines it appears to be the practice among builders to make the cylinder head and bolts immensely stout, so that if anything happens the cylinder is sure to be ruined. Is there not a chance for reform here?

W. E. CRANE.



GAUGE LATHE.

No. 4 Gauge Lathe with Back Knife Frame Attachment.

The engraving shown herewith represents the latest improved gauge lathe, made by the Egan Company, 239–259 West Front street, Cincinnati, Ohio. It is especially designed for turning extension table legs, and work of a similar class up to 3" diameter and 42" in length. The machine is said to have a capacity of 600 table legs in ten hours, or one every minute, doing the work in a first class manner.

The frame or bed is made in one solid piece of metal, planed accurately, so as to have the centers in perfect line, and to have a sliding rest move back and forth in line with the centers. This bed rests upon stands strongly braced, giving ample floor surface. The head-stock is furnished with a heavy spindle, large pulley, and long journal boxes, lined with genuine babbitt metal, making the lathe capable of standing any strain it is subjected to. The hole in the spindle is bored extra deep, so as to insure an accurate running center. The tail-stock is fitted up with a gun metal sleeve made in such a manner as to allow all lost motion to be taken up from time to time.

The sliding rest is fitted up with one stationary and one adjustable knife rest, and is operated by a long screw running the full length of the bed.

The back knife frame attachment is connected to the back of the frame, and moves up and down in planed ways, which are adjustable for taking up from time to time all wear and tear which may occur. There are three changes of feed furnished with each machine, to suit the different kinds and diameters of stock to be turned.

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Standard Bolts and Nuts.

The maintenance of standard bolts and nuts is a matter of great and increasing importance to all who are connected with machinery interests. Standard bolts and nuts are better for the makers of taps and dies, for bolt makers, for machine builders and for machine users.

Most makers of taps and dies for the market, we are glad to say, encourage the use of U. S. Standard threads, the reason for their doing this being the obvious fact that the general adoption of the system would make their business much more satisfactory in many ways—there would be much less chance for misunderstandings, and stocks of taps and dies carried could be much smaller for a given volume of business.

There have been cases where customers have insisted upon being supplied with taps and dies "flat top and bottom" to cut rough iron and to tap nuts for the bolts so made, and their idea too often is that to make these it is only necessary to make them large enough for the rough iron as it comes, and they will still be U. S. Standard bolts. This is a mistake; such taps and dies are not U. S. Standard, and should never be marked or called so. It is true that, strictly speaking, the same may be said of the bolts produced by Mr. Bauer's system; but if so, then it is equally true of those made under the system adopted by the Master Car Builders Association; for any variation, however slight, may be said to bar a bolt or nut from being properly called U. S. Standard; but practically, as shown in the article on page 2, these bolts are standard, or as near so as it may appear to many to be practicable to keep them when using rough iron. The matter presented is one which is worthy of serious attention in our opinion; its adoption in many establishments we know of would certainly be very beneficial, and would result in great economy. It is to be hoped that makers of taps and dies will, when they have customers who want to adhere to the U. S. Standard, and yet must make bolts of rough iron as found in the market, recommend some such system as the one described rather than one which involves a departure from standard size at the bottom or sides of the threads. Our table and formulæ are so arranged that they may be cut out, pasted upon cardboard and used as a reference in the shop or drafting room. We do not propose this system as a substitute for that adopted by the Master Car Builders Association; for where that system can be used the bolts made by it are closer approximations to the real U. S. Standard, provided always that the system is strictly adhered to. But we have serious doubts as to whether all the shops supposed to work by the Master Car Builders Association system really get bolts that are as near the standard as Mr. Bauer's are; for he finds it entirely practicable to strictly adhere to his system, and his bolts and nuts are strictly and uniformly interchangeable—something which can by no means be said of all the car shops.

The matter is well worth looking into by all who are interested in bolts and nuts, and that includes everybody who is interested in machinery.

Heedlessness.

Some two weeks ago there was a fire in a tenement house in New York, which resulted in loss of life. There is nothing remarkable in this, except that it is not even of more frequent occurrence; but there is a lesson in the manner in which the fire was started, which was by the free use of naphtha for cleansing some article of furniture, and a lighted lamp to observe how the cleaning went on. The naphtha was being used for the purpose named by a physician who must, of course, have been an educated man. This at first thought would appear to be the strange thing about the occurrence. There is no one of ordinary intelligence that has not heard and read repeatedly of the danger of doing just what was done in this case. Why it was done can only be explained on the theory of that familiarity which begets contempt.

It is very commonly observed that those who are accustomed to the use of those things that may become dangerous when not handled with proper care become much more careless in such use than the novice. In the use of machinery, for example, no amount of caution will make men reasonably careful for any great length of time. As an example of this, three men were severely—one, or perhaps two of them, fatally—injured in a machine shop within a short time, comparatively, for doing just what the rules of the shop prohibited. These men were perfectly aware of the risks they were taking. If they had known less about them it is probable they would not have been injured. Perhaps if the physician had known less of the danger of using naphtha as he used it—known just enough about it to understand that in some way or other it was not well to handle it carelessly—he would not have sacrificed himself and others.

A large percentage of accidents in which life is lost come rather from heedlessness than from lack of knowledge.

The increase already made in the price of anthracite coal by the great combination of railroads and mine owners, with the probability of a further increase, is stirring up inquiry and discussion as to what can be done by the people in their own behalf. The profits of the coal operators, there is good reason for believing, was disproportionately large before the advance, and this advance will, if it goes no further, put millions of dollars into the pockets of those who are cornering the business, at the expense of the people. It is the opinion of some that the combination is illegal, but we do not believe that it will be so declared. This may be bad for the people and bad for the law, but it is very doubtful if, under existing laws, the combination can be prevented from increasing the price of coal at its will. There is, of course, a limit beyond which it will not be profitable for the coal operators to go, and that is about where the combination will stop. In the meantime, the people, by a slow process, may get stirred up to the point of demanding that laws be enacted by the operation of which they may obtain some of their natural rights. It is to be hoped that this may be the case.

The fact that anthracite coal cannot be satisfactorily contracted for in the eastern part of the country has led some manufacturers who use a large quantity to look to the substitution of bituminous coal—we believe in some instances to contract for it. But should this become anything like common the combination will undoubtedly find ways of controlling that trade as well as the trade in anthracite.

In many places where water-power is going to waste more and more will there be efforts to utilize it by electrical transmission. Undoubtedly in many instances this will be found practicable. But steam engine builders need not be in anywise discouraged. It is not within the bounds of probability that the amount of power thus transmitted will ever be more than a very modest fraction indeed of that furnished directly by steam engines—not enough to be found in the total business of building and selling steam engines. The truth is that for moderately large powers there is much less saving in water-power as compared with steam power than there is generally believed to be, but when it comes to furnishing small power in a good many places within a small radius, the cost, counting attendance, should be less with electrical transmission from a central station than by direct power, whether the power is had from falling water or from steam.

The old apprenticeship system was wanting in that under it skill of the hands was all that was thought essential. The new system—what there is of it—is superior in that it pays some attention to cultivating the thinking qualities of the apprentice.

Literary Notes.

HOW TO MAKE MONEY OUT OF INVENTIONS. An Adviser to Patentees. By August Schemmel.

This little paper-covered book gives good and sound advice to inventors in regard to how and what to patent, how to dispose of patents, and a few hints in regard to the patent laws in foreign countries. The whole forms very useful and interesting reading, and covers 68 pages. In the remaining portion of the book, about 71 pages, the addresses of about three thousand manufacturers and agents engaged in the various industrial branches are given, for the purpose of enabling the inventor to place the selling of his rights in the proper channels. The book is published by C. A. Rohde Co., publishers and booksellers, Milwaukee, Wis. Price, 50 cents.

Sparks from the Crescent Anvil is the name of a monthly publication issued by the Crescent Steel Co., of Chicago. From an inspection of the first number, and from the short editorial announcement, we assume that its space will be mainly filled with matters pertaining to steel—hints as to its treatment, use, etc. A. L. Butler is the Chicago editor, and P. H. Patriarche, who manages the business of the company at 480 Pearl street, the New York editor. Mr. Patriarche has had previous experience in this kind of work. We wish the new enterprise the success we have no doubt it will deserve.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(198) W. H. G., Springfield, O., asks: How are the balls made that are used in the bearings of bicycles? *A.*—You will find a description of the process in our issue of April 18, 1889.

(199) G. B O., Syracuse, N. Y., asks: In turning a taper with the tool above or below the center, will the resulting taper be straight or curved, and, if curved, why? *A.*—It will be curved. The reason was explained in our issue of May 6, 1882.

(200) M. S. S., ——, asks: Can machinery steel be welded, and if so, what is the process? *A.*—Machinery steel is frequently welded, and the process is much the same as for welding iron. Most any good blacksmith can weld machinery steel without difficulty.

(201) W. D. G., Swansea, Canada, writes: I am getting up a horizontal drill, but in sizing the steps of the cone pulleys I am "dead stuck." Kindly give me the information needed. *A.*—You will find this subject thoroughly explained in our issue of December 1, 1888.

(202) J. S. P., Paterson, N. J., asks: In grinding tools will the temper be changed by heat, provided this heat does not rise above that required to give the temper originally? *A.*—We do not think the temper will be sensibly changed unless the original drawing temperature is exceeded.

(203) F. A. K., ——, writes: Will you please give the proper position for a thread tool in chasing taper taps? I have asked several machinists and they all differ. *A.*—It should be set so that the two sides of the tool will make an equal angle with the center line of the tap, *i. e.*, set it square with the center line of the tap.

(204) C. A. M., Bay City, Mich., writes: Please tell me where I can get the book entitled "Mechanics Self Taught." Or if you have a catalogue of books please send me one. *A.*—We have not seen the book, and do not know by whom it is published. Write to any dealer in scientific works for a catalogue; we do not keep any, as we do not deal in books.

(205) J. M., Pittsburgh, Pa., writes: I would like information as to how small bevel gears are planed to shape theoretically correct. I find that in using a cutter of fixed curve, gears of less than 25 teeth will not work correctly unless filed slightly.

A.—Such gears are usually planed on the Bilgram bevel gear machine which was illustrated and described in our issue of May 9, 1886.

(206) B. B. F., East Pepperell, Mass., writes: Please give me a description of a Corliss engine. I have one of 480 horse-power, but I have never had anything to do with this class of engines before this. The engine pounds considerably, and works better as a non condensing than a condensing engine. If you have a back number containing a description of such an engine please refer me to it. *A.*—See our issue of July 3, 1890.

(207) T. B. P., ——, asks: How can cold rolled iron be straightened after it has been machined on one side, so that it will be as straight as before and without short kinks? *A.*—It depends a little upon what shape the cold rolled iron is. But generally speaking it may be best done in a screw press which is provided with centers or rollers to support the iron and movable blocks which can be placed at a distance apart proportioned to the bend it is desired to take out.

(208) A. B., Chicago, asks: Can small malleable iron articles be case-hardened so as to maintain their strength and present a hard, resisting surface? *A.*—They can be case-hardened by heating in a lead bath, applying cyanide of potassium, again heating for a moment and then quenching in water. It is not probable, however, that castings treated in this way retain their full strength. It is usually practiced for parts of such castings only where hardness is of more importance than maximum strength.

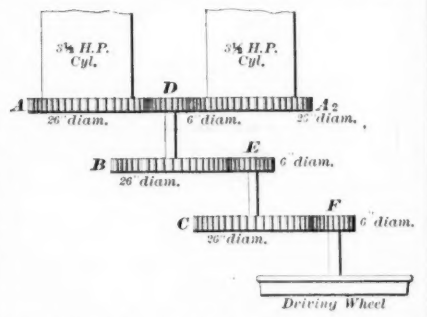
(209) B. B. C., ——, writes: Please state the exact taper to the inch of the following: Shanks of Morse twist drills, shanks for Morse shell reamers, and of the hole in spindle of Bickford drill. *A.*—In our issue of April 9, 1891, answer to Question 166, we have given the taper of the Morse drill shanks, and fuller information regarding this will be found in issues of November 29, 1884, and April 4, 1885. The Morse Twist Drill and Machine Company inform us that the taper holes in their shell reamers are $\frac{1}{2}$" to the foot. We do not know the taper of the holes in the spindles of the drill press named, but presume it is "Morse."

(210) A. F. C., ——, asks: When and by whom was the first steam or compressed air drill made to use on granite? *A.*—We cannot say positively. There are various claims made. In 1849, J. J. Couch, of Philadelphia, patented a percussive rock drill, but the first direct-acting air or steam drill that we find patented was by J. W. Fowler, in 1851. 2. Was it first used at the Hoosac tunnel? *A.*—This, we believe, was its first extensive use, and we think there was no successful steam or air drill used previously. It was the Burleigh patent, and was first used at the tunnel in 1865. 3. Was there one used as long ago as 1840, but was not practical? *A.*—It is very possible that such is the case, though we find no record of it. 4. When and by whom was the first electric drill patented? *A.*—We do not know. You can ascertain by searching the patent office records, so far as American patents are concerned.

(211) E. M., Chicago, Ill., writes: I have had five years' shop work and understand algebra, plane and solid geometry and trigonometry, and have a slight knowledge of machine design. I will be able to devote one year to study in any school or college or by myself. Please recommend, through your columns, a course for me to pursue so as to make the most of my time in learning mechanical engineering. *A.*—We should advise you to join a technical school or college. A course of study in mechanical engineering requires more than one year, depending on the advancement you have made in your studies before you enter a college; but after you have taken one year's course you will undoubtedly know, with the advice of the professors, what studies to pursue afterwards. If you cannot join a school or college we should advise you to engage a good teacher; or if you decide to study alone, follow the course indicated in our issue of February 19, 1891.

(212) "A Reader" asks: "Will you please give me the rule used by the Morse Twist Drill and Machine Company in spacing the flutes of their hand reamers? *A.*—We do not know what rule they use, but suppose they do not use any. They probably use index plates which have been properly divided to give the result desired. No rule is really necessary for this. All that is required is that the teeth shall not be evenly spaced, and whether the variation be little or great within practicable limits makes little difference. The "staggering" can be properly given on the B. & S. machine, or on any machine having a movable index plate, by making the regular movement for the given number of teeth by the regular index pin and then moving the index plate back and forth to give the variation, cutting opposite teeth at one setting of the plate, so that the reamer can be calipered. That is to say, after the first cut is made, turn the reamer half way round, and cut the opposite tooth; then move the index pin for the next tooth, but before cutting it move the plate in the opposite direction, say three holes. Cut two more teeth, and at the next indexing set the plate back two holes; at the next only one hole; and then commence moving it in the same direction as the index pin moves, thus constantly varying the real movement of the reamer, yet making the regular movement of the index pin.

(213) W. B. C., ——, Ill., writes: Kindly answer the following questions through your columns. 1. What is the rule for calculating the pressure at the end of the stroke of the piston in a steam engine to counteract the momentum of the reciprocating parts? *A.*—It is difficult to compute this pressure to a degree of exactness. The general custom is to design the valve motion so as not to allow the pressure due to compression to exceed three-fourths of the initial pressure in the cylinder. The whole is afterwards adjusted when the engine is running to suit the work to be performed. 2. How is the counterbalance in a disk-crank determined? *A.*—See answer to Question 150, in our issue of April 7, current volume. 3. Do you think there would be any difference, and how much, if any, in the coal consumption of a small engine with a throttling governor, and another with a shaft governor and slide valve, other things being equal? *A.*—That depends much on the design of the governors; a good shaft governor may give somewhat greater economy in fuel than a throttling governor, but the difference will be very small. 4. To settle a dispute, how do you compute the pressure on a slide valve? Do you take whole area of the valve, or simply the area of the three ports? *A.*—This is another difficult problem to solve, and it is still a subject of debate among engineers. The pressure of the valve against its seat varies during its travel; for a rough approximation we should take $\frac{3}{4}$ of the pressure on the back of the valve for the mean pressure against the seat. The pressure on back of the valve is found by multiplying the whole area of the valve by the pressure per square inch in the steam chest. For a more accurate way of obtaining the pressure of the valve against the seat see our issue of June 2, 1883, page 6.



(214) H. C. P., Philadelphia, Pa., writes: I am getting up a new machine with two spring cylinders, as shown in the sketch, and I can figure out the speeds, but I am lost on the power. The cylinders make one revolution per minute. I would like to know the power developed by the gears *B*, *C*, *E* and *F*. Please give an arithmetical rule. *A.*—The wheel *A* transmits 3½ horse-power, or $3.5 \times 33{,}000 = 115{,}500$ foot-pounds. This wheel makes one revolution per minute; its circumference is 6 8 feet, and therefore the force transmitted to the pinion *D* will be $\frac{115{,}500}{6.8} = 16{,}985$ pounds. The wheel *B* makes $\frac{1}{3}\frac{8}{2} = 4.33$ revolutions per minute; its circumference is 6.8 feet, hence the speed at the circumference will be 29.44 feet per minute. This wheel has to transmit the power from both cylinders; that is, 7 horse-power, or $7 \times 33{,}000 = 231{,}000$ foot-pounds; hence the force transmitted from wheel *B* to pinion *E* will be $\frac{231.000}{29\ 44} = 7{,}846$ pounds (fraction neglected.) The wheel *C* makes $\frac{13 \times 13}{3 \times 3} = 18.77$ revolutions per minute; its circumference is 6.8 feet, hence the speed at the circumference will be $18.77 \times 6\ 8 = 127.63$ feet per minute. The wheel has to transmit 7 horse-power also, hence the force transmitted by the wheel *C* to the pinion *F* will be $\frac{33{,}000 \times 7}{127.63} = 1{,}809$ pounds. In the foregoing computations friction has been neglected, which, if taken into consideration, will slightly reduce the above forces. But the error in taking these forces for proportioning the teeth, which we presume you want to do, will be on the side of safety. 2. Please recommend a good book that will give the information wanted. *A.*—Any good elementary work on "Mechanics" should give the information. See our issue of February 19, 1891, page 4.

(215) Amateur, Galt, Ontario, writes: I am studying machine design, and would like to ask your advice as to a book that will give the amount of knowledge of pattern making and molding necessary to design castings. I often find myself at a loss to know whether or not a casting can be economically made. *A.*—You will find a great deal of information on this point scattered through the back numbers of the AMERICAN MACHINIST, and, chiefly from this matter, some books have been published which will give information. They are: "Molders' Text-book" and "American Foundry Practice," by West; the "Iron Founder," by Bolland. There is also an English work, "Practical Iron Founding," by an anonymous author, published by Whittaker & Co., London. All these can be obtained of American publishers of technical books. Much that cannot be found in any book can be learned by going into a foundry. 2. Can I get any work giving me an insight into the resistances to be overcome in working machinery, say iron or wood-working? I see belts and pulleys used that could transmit four times the power it takes (in my mind) to drive the machines. *A.*—There is comparatively little that has been published on this subject, and the fact is that designers have not very strongly felt the need of definite information on these points. The usual practice is to observe what other machines do and what their limitations are with regard to strength and driving power; then to make the new machine as powerful and strong, or more so. Some experiments, made we believe by Wilfred Lewis, at the works of William Sellers & Co., showed that the resistance in cutting steel in the lathe or planer would vary from 180,000 pounds to 700,000 pounds per square inch of section removed, while for cast-iron the resistance is about one-third as much. In our issues of Aug. 14, Nov. 6 and 13, Dec. 4, 11 and 25, 1890, and Sept. 11 and 18, 1886, you will find articles treating of this matter. In our opinion you will find very few machines or tools that have an excess of driving power, whatever your idea of it may be from a mere inspection of the belts and pulleys. The Westinghouse Machine Co., of Pittsburgh, issue a supplement to their catalogue, called, "Supplement to Wood-workers," in which particulars of some tests made to determine the power required to drive wood-working machinery are given. This can be obtained of the company.

(216) E. B., Worcester, Mass., writes: Please give me a formula for smallest diameter of pulleys and shortest distance admissible to have between centers of shafts with crossed belts, and the longest distance with open belts without carriers. *A.*—We know of no formulas for such matters. Each case must be decided and arranged in accordance with the conditions presented. As to the shortest distance admissible for crossed belt, we should, if necessary, make it no more than equal to the diameter of the larger pulley, but should make it as great as possible, certainly up to about 15 feet, and it may, of course, be more than this, according to width of belt and size of pulleys, the only l mit, so far as the belt itself is concerned, being that at which its weight becomes objectionable or the flapping motion excessive. 2. The distance between centers of two shafts is 90 feet. Would you prefer to put in an intermediate shaft and make two belts; or would you use one belt and carriers? The belt is 8" double; pulleys, 5 feet diameter; 150 revolutions per minute. *A.*—Under ordinary conditions we should not consider either to be absolutely necessary, as such a belt should work satisfactorily without support. If the belt were to be made endless, or cemented, our preference would be for the idler or idlers unless some special conditions made the intermediate shaft advisable. 3. How can I figure which is most, the transverse or the torsional stress on a shaft, when the distance between bearings, diameter of shaft, diameter of pulleys, number of revolutions per minute, and horse-power transmitted are known? *A.*—Practically you cannot determine without making some experiments in each case. Engineers do not usually bother to figure out such things, but apply the well known formulas for shafting, modified to suit conditions and guided by individual judgment and experience. You can calculate the torsional stress upon a shaft by the following formula $S = \frac{Pp}{.196d^3}$, in which *S* equals the stress per square inch, *P* the pull in pounds at the end of the lever, or at the surface of the pulley, *p* the radius of the pulley in inches, and *d* the diameter of the shaft in inches. This gives the stress per square inch at the surface of the shaft, or in the outer fibers. The transverse stress may be found by the following formula $S = \frac{M}{.098d^3}$ in which S = the stress per square inch, d the diameter of the shaft, while the value of M depends upon how the load is applied. If the pulley is midway between bearings $M = \frac{Wl}{4}$, in which W = the weight, or in this case the total pull exerted by both sides of the belt used as one component of a force which is the resultant of this and the weight of the pulley, and l is the length of the shaft between bearings.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gear Wheels, Gear Cutting, page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Ideal Drawing Stands. M. C. Hammett, Troy, N Y.

A. D. Pentz, Consulting. Tools. Elizabeth, N. J.

Armstrong Tool Holder. Armst'g Bros., Chicago.

Ag'ts & sub's wanted. Scientific Mach., Clev'd, O.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Detail drawings, lathes 12" to 24", other machine tools. John G. D. Mack & Co., Cincinnati, O.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

S. A. Smith 23 S. Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

"Boiler Tests by Barrus." Get sample pages from Gowing & Co., Mason Building, Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Most sensitive and durable Damper Regulator made; works within one pound. Send for circular. T. Kieley, 11 W. Thirteenth Street, New York.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

25" / 32" / 37" / 42" — "Only Drill Press built on 'Ko-rekt' principles, Even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Complete treatise on Screws and Screw-making, with clear and consise explanation of the methods; 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt St. N. Y.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases.
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886 issue; must be unsoiled, and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Just Published: "Ways & Means" for Machinists & Metal Workers. A new work, thoroughly practical, containing new matter that no intelligent mechanic should miss. The cheapest work ever issued, 160 pp., 150 illustrations, including working details of the latest mach. tool design & prac. Cloth. Price $1. John W. Weston, Pub. Journal of the Association of Eng. Societies, 78 La Salle St., Chicago.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Just Published: Safety Valves; their History, Invention and Calculation, including the most recent examples of Weighted and Spring-loaded Valves, also showing the effect of Atmospheric Pressure on Safety Valve Disks; showing the curious phenomenon of balls being sustained by an inclined current of air, Vacuum Valves, etc., etc., by William B. LeVan. Fully illustrated, pocket-book form, $2. Our Book Catalogue sent free. Norman W. Henley & Co., 150 Nassau Street, N. Y.

Good Screws in Bad Places.

BY EASY WAY.

Since the chaser—the *hand*-chaser—went up on the high shelf to stay, the "drunken thread" has become a thing of the past; the day was when it was common enough, but the ordinary engine lathe cut screw is, for all practical purposes, true; and good screws are also made on screw machines where the threads are cut wholly by dies. I *believe* that very few screws made on the screw machine have the same "lead" or angular advance at all points of the circumference, but they are fair, and some of them very good indeed. I think it may be safely assumed for the purposes of this article that screws in general as now made and used in American practice have threads varying only in a small degree from true spirals. I well remember the day when such was not the case. As late as 1862-3 I saw a lot of

1¼" cylinder studs with threads so "drunk" that the nuts cleared the cylinder heads by nearly $\frac{1}{16}$ on one side when they touched on the other side. They were bad, were condemned, and thrown away. We have advanced in screw making, but how about nuts and tapped holes?

For rough nuts the present practice produces surprisingly good results; the holes in the nuts are punched *very* nearly at right angles to the face; the long vertical tap of the automatic nut-tapping machine finds the center of the hole, and our rough nuts are as good, perhaps, as they need to be, and I believe that in a vast majority of cases the rough nut is just as true as the finished nut.

Suppose a rough nut, tapped out, is to be finished by common practice. The nut is screwed on a solid "nut arbor," as shown in Fig. 1. The thread is short, so as to face up a thin nut, or because thin nuts have been faced up on the arbor and the thread cut away in so doing; this short thread is certain to be a slack fit in the standard size nut, because it is worn out almost as soon as it is put in use, and who ever heard of making a new nut arbor so long as the old one would hold a nut to face it up? It is a matter of certainty that the arbor thread is nowhere near a fit for the thread in the nut; if made a good fit in the first instance, the fit is gone by the time the first hundred nuts have been forced up against the shoulder hard enough to hold still while a quick cut is taken over the outer face of the nut, and the "improver" who runs the nut lathe knows that he is not expected to be "all day on those nuts."

When you come to think of it, there doesn't seem to be much chance for the nut to come out of the lathe with the face much nearer square with the thread than when it went in, does there? Right you are, and I don't believe there are many true faced nuts made anywhere, and some large shops never make *one* true nut, or even a nut that is pretty nearly true.

No matter—a good wrench will pull the nut down to a bearing all round, and if it comes loose just put a "jam" nut on top of it, a thin one, of course, because the top one does all the holding, and the thick one acts merely as a washer, so far as keeping the piece held by the bolt or stud in position goes, and if the nut keeps working loose, keep on screwing it down, until some day the bolt gets "crystallized" and lets go, and then the monkey-wrench can have a rest until another bolt is made. Of course the short bends made by the wry faced nut have no connection with "crystallized" bolts.

To avoid all this, some shops use a taper thread on the nut arbor, and omit the shoulder. Certainly if a nut is screwed up on a taper thread with no shoulder, it *must* square up true with the axis of the thread. That is to say—well—not exactly *must* come out faced up true; it may stand true or run true with the axis of the thread before a tool is brought up against the slack end of the nut, and it may tip a little when the cut is put on at the loose end, and—yes, it might have a tendency to gnaw the thread on the arbor out of true, and altogether it doesn't seem that the taper threaded arbor is just the thing, either. I pass over the rapid man, who jams two rough nuts together on the first threaded piece he can get hold of that will take the nuts, and then grabs the part that sticks out in a 3 jawed chuck, and faces up the nuts in a hurry; he doesn't fool away any time, that is certain. I also pass the man who puts the nut in the 3 jawed chuck and faces it up without any arbor, and spits on it to make it nice and bright; and I can only give honorable mention to the conscientious mechanic who puts the unthreaded nut in the chuck, bores it out, starts the thread with a thread tool and the screw gear, and finishes with the tap, and faces the nut off before taking it out of the chuck; he *does* face the nut true; but it costs too much to do it that way. That is *one* way to make a true-faced nut, and I know of only one other way which will make a really true-faced nut, and that way happens to be in the long run as cheap and easy as the worst method, as shown in Fig. 2.

Take a taper arbor, ream a collar which is less in width than the thickness of the nuts to be faced to fit, drive the collar on the arbor, and thread it so the standard nut will run on easy with the fingers, then mill through the threaded collar on one side, and groove across opposite the cut, and drive a pin through the arbor having projecting ends, one of which will slide in the cut in the collar; drive the pin out, slip the collar back, and drive the pin in place again, and the nut arbor is ready to use. When the collar is up against the pin run the nut on with the fingers so it stands over the collar on both sides; use a rawhide mallet to drive the arbor in the collar, and the nut arbor will last a great while; and all nuts faced on it will be square in reality as well as in appearance.

So much for the nut. The tapped hole is another thing.

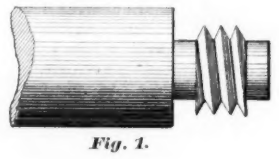


Fig. 1.

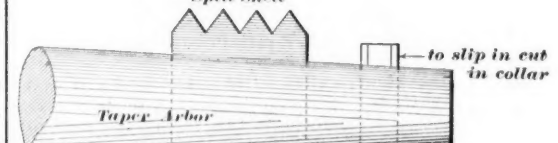
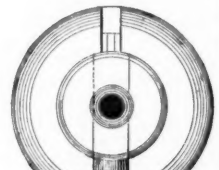


Fig. 2.

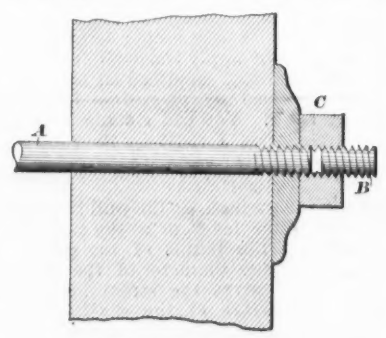


GOOD SCREWS IN BAD PLACES.

The latest monthly reports of the English trade union societies connected with engineering industries show a falling off in trade, which has been the case for some months. The number of members unemployed appears to be constantly on the increase, and prospects for the usual activity are not encouraging.

A Builder's Trick.

The accompanying illustration will make clear the trick of a builder, recently discovered during the progress of work on a large building. The superintendent of construction found that a number of the tie-bolts passing through a brick wall were too short, so that they held by only a little more than one thread. He notified the builder that these must be replaced by longer bolts, which would allow the nut *C* to engage the threads for its full thickness. An inspection of the premises a few hours afterward showed that a change had apparently been made in the case of a large number of the bolts complained of as defective, for the threaded end of a bolt *B* projected some distance beyond the nut. The remarkable speed with which the change had been accomplished aroused suspicion, however, and an investigation revealed the trick. Short



A BUILDER'S TRICK.

pieces of rods of the same diameter had been threaded and screwed into the open face of the nut, so as to give the appearance of a bolt passing through, while in reality the nut held as before by only a single turn. —*Engineering Record.*

The keel of a steel sailing vessel—the first built in this country—will shortly be laid in Maine.

The Idlers' Influence on the Labor Problem.

Perhaps the very worst influence of the idlers, however, is to be found in the effect of the spectacle of their lives on what is called "the labor problem." "The labor problem" is really the problem of making the manual laborers of the world content with their lot. In my judgment this is an insoluble problem. No discoveries or inventions will ever solve it as long as population continues to press close on the available products of human industry. The causes of the dissatisfaction of the masses with their condition may change from age to age, but the dissatisfaction will continue, and the blame will be always laid on those who have a larger share of the world's goods than others. But there is no question that the existing discontent is, and not unreasonably, aggravated by the spectacle of the enjoyment by the growing idle class of the benefits of the social and political organizations, without any contribution worth mention to the trouble and cost of maintaining these organizations. The taxes paid by the annuitant or rentier class are but a trifling return in reality for the security they possess for person and property. The workers of the world provide them with police, with courts of justice, and means of travel—in short, every agency which makes their enjoyment possible, for sums in cash which they would hardly pay to a good club. Reasonably or unreasonably, the masses resent this more and more. It gives mere envy an air of respectability and rationality. They say that even if a good defense may be made for inequality of conditions based on inequality of capacity and services, there ought not in truly democratic communities be any people who render no service at all, and who allow others to till, and spin, and weave, and police, and fight, and teach, and invent, and discover, plow the seas and dig the mines for them, while they look on and draw their quarterly dividends and spend them in childishness; that we shall never have social peace till every man has a fair share of the social burdens.—*E. L. Godkin*, in the *May Forum*.

Some idea of the use that is being made of typewriting machines in this country may be had from the statement that one make of machine is sold at the rate of one every five minutes.

The Department of Agriculture concludes that at least 15 per cent. of the entire food product of the country is adulterated, the loss to the consumer in a financial sense being estimated at $700,000,000.

MANUFACTURES

The Chicago (Ill.) Tire and Spring Co. is enlarging its plant.

Keely Bros., Goshen, Ind., will establish a machine shop.

The Oxford (N. Y.) Electric Light Co. has been organized.

An Edison electric light station will be erected at Aquidneck, R. I.

W. D. Troutner will build a new machine shop, foundry, etc., at Pittsfield, Ill.

The Vanderbilt Sash Balance Co., of Canandaigua, N. Y., has been organized.

It is probable that the Oriental Torpedo Factory at North Brewer, Me., will be enlarged.

The Northern Pacific Car Truck Company of Chicago, Ill., has organized; capital stock, $2,000,000.

The Stewart Wire Co. has been incorporated, at South Easton, Pa., with a capital of $400,000.

Machinery for a 2,500 spindle cotton-mill is to be put in by C. E. Falls, King's Mountain, N. C.

The Crane Machine Co. will lease the machine shops in Shepherdstown, W. Va., and start them up.

The nail mill of the Kelly Iron and Nail Company, at Ironton, O., resumed operations on the 14th inst.

The Crucible Steel Works Co., at East St. Louis, Ill., has increased its capital stock from $75,000 to $300,000.

Efforts are being made to organize a stock company to establish an electric light plant at Hawarden, Iowa.

An effort is to be made to form a stock company for the manufacture and sale of patent ice crushers at Palmer, Mass.

The Long Island Machine and Marine Construction Company of Long Island City; capital, $15,000. A. R. Boyle is interested.

An addition is to be made to the Bradford Mills at Somerville, near Germantown, Pa., which are operated by J. & J. Dobson.

J. Mathews, boiler manufacturer, of South Bend, Ill., has accepted a good offer, and will shortly remove his works to Harvey, Ill.

The Ketcham Iron Co., at Fort Smith, Ark., has increased its capital from $15,000 to $50,000, and will largely increase its facilities.

The Drive Chain Manufacturing Company, capitalized at $100,000, has been organized at East St. Louis, Ill. A. E. Gibbs can inform.

The Delaware Railroad Company will erect a bridge across the Delaware and Chesapeake Canal, at Kirkwood, Del., at a cost of $150,000.

The Cumberland (Md.) Steel and Tin-plate Company has been organized. Capital stock, $300,000. J. W. Humbird and others, incorporators.

It is said that the Baltimore & Ohio Railroad has purchased 20 acres of land, at Cumberland, Md., and will erect extensive shops at that point.

The Western Car Spring Company, of Chicago, has been incorporated by Geo. E. Marden, C. S. Burden and others. Capital stock, $250,000.

Thompson & Bushnell Co., of New York, has been organized, and will manufacture attachments for steam engines and boilers. Capital, $10,000.

The Niles Tool Works, Hamilton, Ohio, has issued a catalogue of bending and straightening rolls, which is very finely illustrated and printed on excellent paper.

Milliken, D'Amour & Co., makers of fine machinery and tools, have issued a catalogue illustrating and describing a small sensitive drill which they manufacture.

The trustees of the New Hampshire College of Agriculture and Mechanic Arts have appropriated $20,000 for the building and equipment of a new machine shop.

The B. & O. Foundry at Wheeling, W. Va., has been closed, throwing 80 men out of employment. It is reported that the plant is to be removed to some other point.

The Stonemetz Printers' Machinery Co. is moving their machinery from Millbury, Mass., to Brooklyn, N. Y. This company, it is said, contemplates building printing presses.

Felt & Tarrant Manufacturing Company, 52 Illinois street, Chicago, Ill., issue a circular explaining the use of the comptometer, or universal calculating machine, made by them.

It is said that the firm of Morewood & Co., of Swansea, South Wales, will establish works for tinning plates at Elizabethport, N. J., having bought three acres of land for the purpose.

The contract for erecting the works at Middlesborough, Ky., for the South Boston Iron Works, has been let to Waggoner & Gerenflo for $125,000, the work to be completed by October, 1892.

George L. Seth and Winifred Brook will build a foundry and machine shop near the crossing of Detroit street and Lake Shore R. R., to be called the West Cleveland (O.) Foundry and Machine Shop.

It is announced that the entire plant of the Cleveland Axle Mfg. Company, of Cleveland, Ohio, will be removed at an early date to Canton, Ohio, in consideration of a bonus of $25,000 and a free site.

The Shelby Cycle Mfg. Company, Shelby, Ohio, have decided to engage in the manufacture of steel tubing in connection with the Shelby Steel Tube Company, and will abandon the manufacture of bicycles.

The Davids Machine Works, 75-79 Center street, New York, issue a circular setting forth their facilities for doing general and special machine work, perfecting inventions, making models, revising designs, etc.

David Bell, Buffalo, N. Y., issues a catalogue illustrating and describing a line of steam hammers which he manufactures. A large number of references are given from those who are using these hammers.

A. H. Hammond & Co., of Worcester, Mass., have conveyed the factory buildings, land, stock, machinery, etc., on May street, to the Hammond Reed Company, a new corporation, which succeeds to the business.

The Duvall Engine Works, which were removed to Roanoke, Va., from Zanesville, O., are about ready to begin the manufacture of machinery, builders' iron and castings. They will give employment to 100 men at the start.

The International Steam Power Co., at Olean, N. Y., has been incorporated, in West Virginia, for manufacturing and dealing in steam boilers, engines, machinery, etc., by E. M. Johnson, G. H. Strong, and others; capital, $100,000.

The New England Electro-Therapeutic and Alarm Co., capital stock, $100,000, $15,000 paid in, has been organized at Biddeford, Maine, for the purpose of manufacturing electric and other appliances. The president is Wilbur L. Libby, of Boston, Mass.

The Pittsburgh Locomotive Works have begun the erection of a new machine shop at their works, at Allegheny. It will be built of brick, with iron frame-work, and will be 365x125 feet. They are also building a blacksmith shop, 365x100 feet, with an 80-foot wing, which will be used for a hammer shop.

W. H. Denney, Lancaster, Pa., manufacturer of clamps, hand screws, etc., has formed a company which is now conducting the business under the title of Denney Hand Screw and Clamp Co. The business has been broadened, the new company not only making hand screws and clamps, but furnishing all kinds of clamps for any purpose, made by other manufacturers; in fact, is doing a general business in selling clamps.

The Berlin Iron Bridge Company have received the contract for the new rolling-mill which the Waterbury Brass Co., of Waterbury, Conn., will build to replace the one lately destroyed by fire. It is said that this will be the finest rolling-mill in the Naugatuck Valley, being 150 feet in width by 350 feet in length, with brick side walls and iron roof trusses covered with the Berlin Bridge Company's patent anti-condensation corrugated iron roof covering. The building will be absolutely fire-proof.

Henry R. Worthington, 86-88 Liberty street, New York, has issued a new general catalogue of the Worthington pumping engines, steam pumps and hydraulic machinery. While the catalogue does not contain a list of all the pumps made for various purposes by this house, it contains enough to give a very good idea of the great variety manufactured. The catalogue is finely illustrated by wood-cuts, and contains several outline engravings, upon which the parts are designated by figures to facilitate the ordering of duplicate parts. A telegraphic code and an index to code words is appended.

Machinists' Supplies and Iron.

NEW YORK, May 7, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15.75 to $16; No. 2, $14.75 to $15; Gray Forge, $13.75 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $14.25 to $15 for No. 2; and $13 to 13.50 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is firmer.

We quote Hallett's, 11¼c. to 11¾c.; Cookson's, 14½c. to 15c.; and L. X., 13c. to 13½c.

Copper—There are no fresh developments to influence the price of Lake Copper, for which 12c. to 12.20c. is asked. Casting Copper is quoted at 11.25c. to 11.40c., according to quantity.

Lead—The market is on a firm basis, holders are asking 4.30c. to 4.32½c; buyers are very cautious in their bids. The stiff views of the sellers is the only drawback to business.

Lard Oil—The market is firm at 56c. to 57c. for Prime City. Western on spot is quoted at 55c. to 56c.

Spelter—There is no perceptible change in the market, which remains extremely dull at the nominal price of 4.90c. for carload lots.

Tin—The market is weaker, in sympathy with advices from abroad. The speculative interest has revived, and sales have been made at 20.60c. for 25-ton lots.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Two draftsmen posted in automatic engine work. Address Stearns Mfg. Co., Erie, Pa.

Wanted—A man with small capital to operate foundry. Address J., AMERICAN MACHINIST.

Wanted—Position by mechanical draftsman: references. Address A. M., AMERICAN MACHINIST.

Wanted—3 exp'd mech. draftsmen for about 3 months. Geo. D. Dutton, Springfield, Mass.

Wanted—Position as foreman with concern m'f'g small interchangeable work; can design tools and labor-saving devices. "No Slouch," AM. MACH.

Pattern making foreman wants re-engagement, first-class refs.; well up in modern foundry practice, good draftsman. A. C., AM. MACHINIST.

Wanted—A first class mech'l draftsman; state age, exp., and salary expected. Permanent position to the right man. Address Box 101, AM. MACH.

A general mechanic, theoretical and practical, strictly sober and industrious, but unable to furnish reference, desires employment. A. O., AM. MACH.

Wanted—Foreman for boiler shop, one who thoroughly understands the business. None but first-class need apply. Steady work. Give reference. S. V. Machine Co., Louisville, Ky.

Mechanical draftsman, familiar with modern shop practice, a designer of machine tools, and special machine tools and fixtures, desires a change. Address Box 103, AM. MACHINIST.

Position, by a mechanical engineer who has occupied position in two manufacturing companies during past 15 years as designer, superintendent, traveler and manager. Address W. N. S., AM. MACH.

Wanted—A good salesman for power-transmission machinery in New York and vicinity. Must be a prac. man, able to plan arrangements and estimate cost. Give age, exp., nationality, wages and refs. "Shafting," P. O. Box 3349, New York.

Wanted—First-class tool maker to take charge of tool room and turret lathes. Able to make tools and set up lathe ready to run. Near New York. Address, stating experience, and wages expected, Monitor, AMERICAN MACHINIST.

Wanted—Foreman of machine shop, in an engine works in the East, employing 200 to 300 hands. Must be familiar with interchangeable and jig work, piece work and other modern methods, and capable of handling men to advantage. Address Box 95, care AMERICAN MACHINIST.

Wanted—A young man to take charge of a shop at present employing a small force of men on repair work in addition to specialties, who is capable of keeping up his end in the enlarging of the business. He must be a first-class mechanic of good habits. Address Business, AMERICAN MACHINIST.

A thor. competent man desires a sit. as working foreman or supt.; 20 years exp.; thorough modern methods on interchangeable work and machine shop practice, devising tools and adapting mach'y to produce economical results; experienced also in electrical work and mach tools, plain buildings; thor. draftsman; good executive, details of contract and piece work system. Fellows, AM. MACH.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd. lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

Best Crank Shaper $225. Am. Tool Wks., Clev., O.

Help, to take orders. F. D. Leslie, Cleveland, O.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

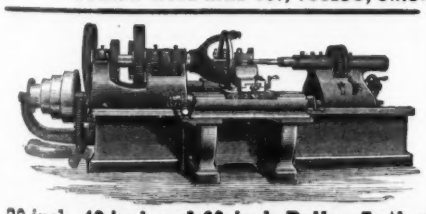
Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

STEEL TUBES
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.

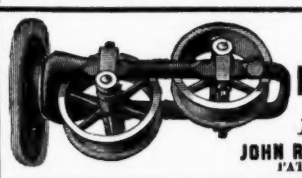
BRASS AND BRONZE CASTINGS
A SPECIALTY.
By a molder of 50 years experience. Castings guaranteed true to pattern. Get my prices.
GEORGE HIBSCH, 4 1-2 Plain St., Albany, N. Y.

ANNOUNCEMENT.
Milwaukee, Wis., April 26, 1892.
We beg to inform the public in general, and Machine Tool users in particular, that all contracts existing between the Lodge & Davis Machine Tool Co., of Cincinnati O., and ourselves, by which they controlled our output of Milling Machines, have this day been canceled by mutual consent.
In the future the genuine Improved Kempsmith Milling Machines can be purchased directly from us or our regularly accredited agents.
We are now in much better shape to make prompt shipments.
With some new sizes of Millers, and other sizes in progress, we will soon have a full line.
We trust that a desire to furnish nothing but a strictly high grade tool, at a moderate price, coupled with fair business methods, will enable us to satisfy our customers in the future as we have endeavored to do in the past.
KEMPSMITH MACHINE TOOL CO.

FOR SALE CHEAP.
Factory and building, including two and one-half acres of ground, located in Toledo, Ohio. Brick iron roof building, erected in 1889, for the purpose of manufacturing wire nails, all complete and containing new 75-horse power engine and boilers, line shafting, etc., and side track connecting with twenty two lines of railroad.
Address Jos. C. BONNER, Pres't
TOLEDO WIRE NAIL CO., TOLEDO, OHIO.



30 inch, 42 inch and 60 inch Pulley Lathes
For Simultaneously Boring and Turning Pulleys, both straight and crowning face, Cone Pulleys, Gear Blanks, and a variety of other work.
Manufactured by
The Henley Machine Tool Works,
RICHMOND, IND.
Duplicate Circular mailed on application.



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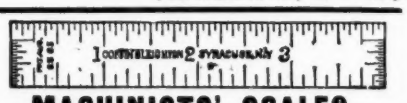
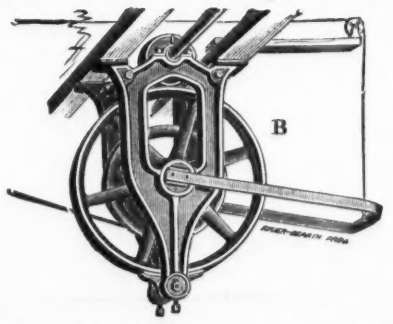
FOR *Light Belts.*
JOHN ROYLE & SONS,
PATERSON, N. J.

FACTORY ROOMS WITH POWER.
Three large halls, each 50x225.
Two halls, 7000 square feet each.
Steam power and heat.
City water; Gas; Cheap freighting.
Easy traction; Steam freight elevator.
Shethar Factory, Elm Street, Yonkers, N. Y.
Apply on premises, or to
T. ASTLEY ATKINS,
140 Nassau St., N. Y. City.



MACHINISTS' SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

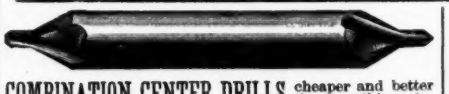
MASON'S
New Patent Whip Hoist.



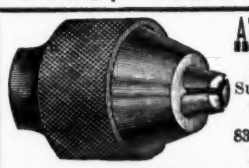
One hundred and eleven in use at the largest new Hay depots in the World, of N. Y. C. & H. R. R. R. Co., 33d St. & 11th Ave., New York, and Lowell M. Palmer's Docks, North 9th and 10th Sts., Brooklyn, N. Y.
Made by VOLNEY W. MASON & CO.,
PROVIDENCE, R. I.

BRADLEY HAMMERS
2000 IN USE.
FOR 20 YEARS these Hammers have been in the market and during all that time have been acknowledged the very best. The material we use and our method of construction are the result of ripe experience and not the jumped-at conclusions of amateurs. Send for circulars and price lists.
BRADLEY & COMPANY,
SYRACUSE, N. Y.

VALVE GEARS FOR STEAM ENGINES.
By PROF. CECIL H. PEABODY.
8vo. Cloth, $2.50. 33 Folding Plates.
JOHN WILEY & SONS, NEW YORK.



COMBINATION CENTER DRILLS cheaper and better than anything else for the purpose. Size of shank 3-10 in. Size of drills 1-8 in. and 3-32 in., or both ends alike, either 1-8 in. or 3-32 in. Sent postpaid to any address in U. S. or Canada on receipt of price. $1.50 per Doz. JOHN T. SLOCOMB & CO., P. O. Box 1339, Providence, R. I.



Almond Drill Chuck
Sold at all Machinists' Supply Stores.
T. R. ALMOND,
83 & 85 Washington St.
BROOKLYN, N. Y.

Hart's Adjustable "Duplex" Die Stocks For Bolts.

AS USED BY Machinists, Model Makers, Blacksmiths, &c,
HART M'F'G CO.
16 Wood St.,
Cleveland, Ohio.
Send for Illus. Circular.

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Send model or sketch for free advice as to patentability. Full information in my fifty page book, FREE.
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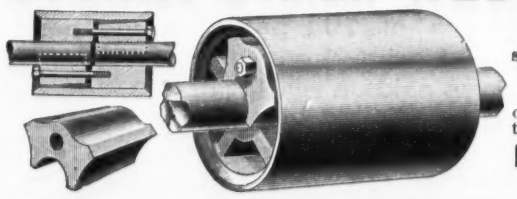
THE NORTON DRILLS.
FOR LIGHT, SENSITIVE AND RAPID DRILLING.
1, 2, 3, 4 or more Spindles, Sensitive or Automatic Feed
To drill from 0 to 1-2 inch holes.
The *Latest* and *Best*; most convenient, sensitive and durable Drill on the market.
Have Balanced Spindles and Balanced Tables.
Write for prices and description, or for Special Machinery.
THE NORTON & JONES
Machine Tool Works,
PLAINVILLE, CONN.
Manufacturers of Machine Tools and Special Machinery.

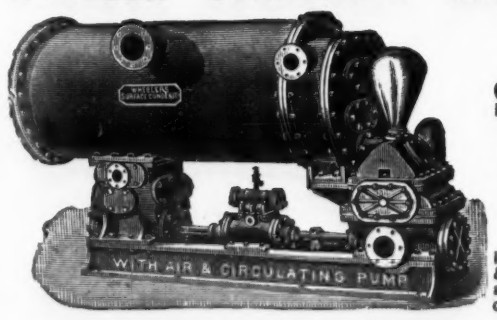
VANDERBEEK'S
MILLING MACHINE.
FIVE STYLES.
DOES STRAIGHT, CIRCULAR AND IRREGULAR WORK.
THE STATES MACHINE CO.,
HARTFORD, CONN.

STUART'S PATENT WEDGE COUPLING.



Uses Neither PINS nor KEYS.
Can be attached or removed in a few seconds without injury to shaft or coupling.
SIMPLEST and BEST in MARKET.
Also the Cheapest. 2 inch, only $4.50; other sizes in proportion. Send for Illustrated Price List of 20 sizes.
ROBERT J. STUART,
NEW HAMBURGH, N. Y.

WHEELER CONDENSER AND ENGINEERING CO.



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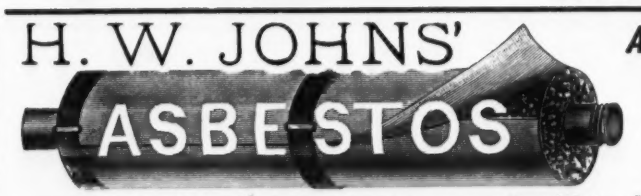
MANUFACTURERS OF IMPROVED
SURFACE CONDENSERS.
ALSO SUCCESSORS TO THE
Colwell Iron Works.
Machinery for Sugar Plantations and Refineries. Vacuum Pans, Double and Triple Effects, &c. Blowing Engines for Blast Furnaces. Iron and Brass Castings for the Trade. Heavy Machinery a Specialty.

H. W. JOHNS'
ASBESTOS



ASBESTOS SECTIONAL PIPE COVERINGS.
Non-Conducting Coverings for Steam and Hot Water Pipes, Boilers, etc.
ASBESTOS BOILER COVERINGS.
H. W. JOHNS MANUFACTURING COMPANY,
H. W. Johns' Asbestos Millboard, Sheathings, Building Felts, Fire-Proof Paints, Liquid Paints, Asbestos Roofing, Etc.
87 MAIDEN LANE, N. Y. JERSEY CITY. CHICAGO. PHILADELPHIA. BOSTON. ATLANTA. LONDON.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Complete mach'y for mfg horseshoes delivered by L. Ingermann, Minden, Westphalia, Germany.

Stolpe's Universal Punch is new and the best; write for circular. Stolpe, 154 W. 27th St., N. Y.

Design & superintendence of mach'y. Drawings, etc., made. Claud Mantle, 598 E. 134th St., N. Y.

Wanted—Every machinist to send for bargain list of tools. E. G. Smith, Columbia, Pa.

For Sale—Machine shop and foundry, and one-half interest in a good water-power. Address Ed. Biddle, Dallas, Polk Co., Oregon.

Wanted—The address of builders of paper making machinery and their circulars. Write "New Mill," care AMERICAN MACHINIST.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy Street, Providence, R. I.

Bound volumes for 1891. We are now prepared to take orders. Price, $4.00 per volume; express charges payable by purchaser. Address AMERICAN MACHINIST, 203 Broadway, New York.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent, Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

Sale of American Patent. Peter Heintz, Ludwigshafer a. Rh. The simplest and best file-cutting machine in the world. The best investment for capital. High profits. Will be sold under favorable conditions by Peter Heintz, Ludwigshafer a. Rh. Bayer, Pfalz.

Machine Tools in Stock.

ENGINE LATHES.

82 in. swing, 34 ft. bed.				Whittier
78 do	9 ft. between centers			Sellers
38 do	17 ft. bed.	New		Fifield
30 do	14 do	do		do
27 do	16 do	do		
24 do	12 do	do		Fifield
24 do	12 do	do		Fitchburg
24 do	12 do	do		Flather
22 do	10 do	New Pattern		Fifield
22 do	12 do	do		do
22 do	12 do	New		Blaisdell
22 do	8 do	do		Flather
22 do	10 do	do		do
20 do	8 do	do		do
20 do	10 do	do		do
18 do	8 do	do		do
18 do	10 do	do		do
18 do	8 do	do		Blaisdell
18 do	16 do	do		do
16 do	6 do	do		Flather
16 do	6 do	do		Blaisdell
15 do	6 do	do		Flather
14 do	6 do	do		do
14 do	6 do	do		Blaisdell
12 do	6 do	do		do

PLANERS.

42 in. wide, 42 in. high, 12 ft. long, 2 heads				Gleason
36 do	36 do	8	do	Pease
30 do	30 do	8	do	do
30 do	30 do	8	do	Whitcomb
30 do	30 do	8	do	Flather
26 do	26 do	6	do	do
24 do	24 do	6	do	do
24 do	24 do	6	do	Whitcomb
22 do	22 do	5	do	do
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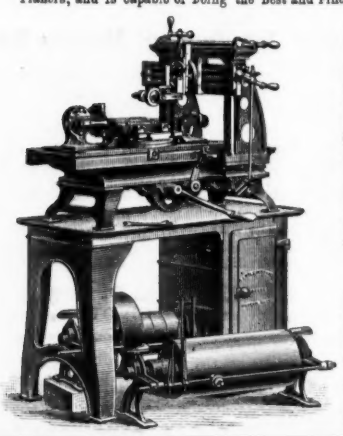

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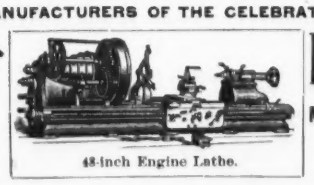

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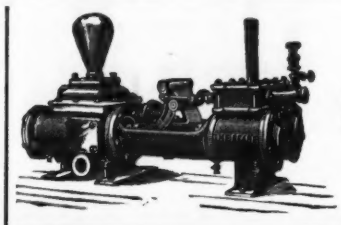

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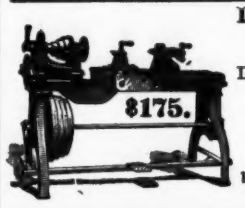

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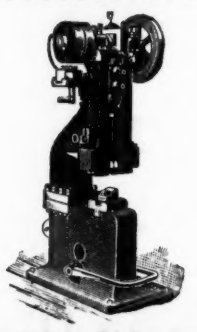

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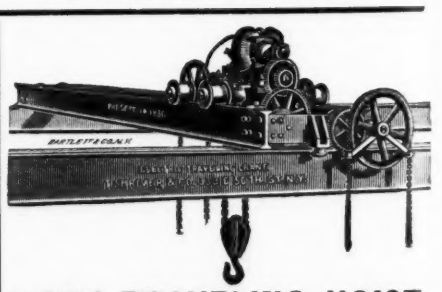

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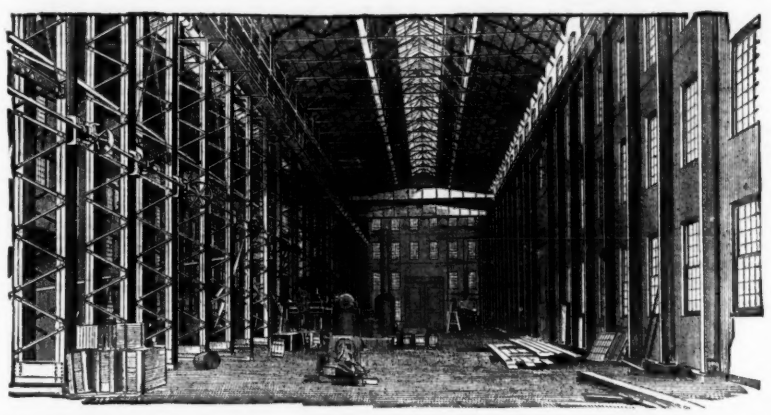

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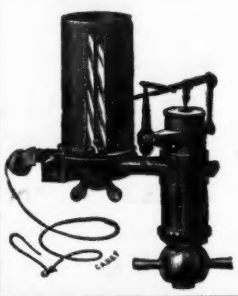

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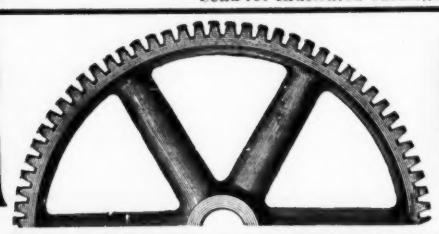

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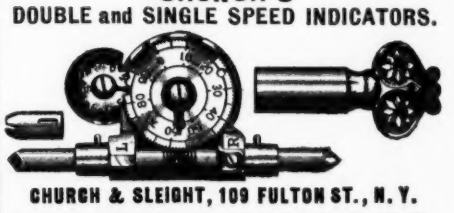

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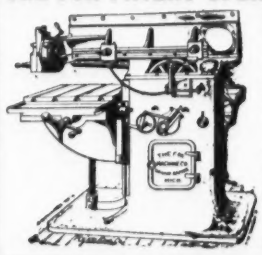

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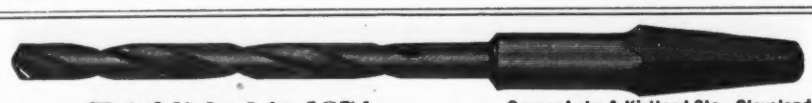

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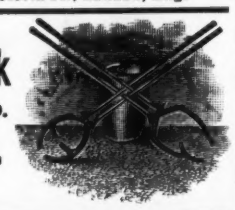

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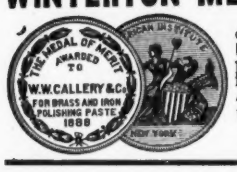

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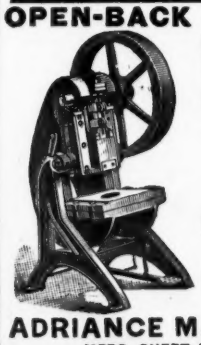

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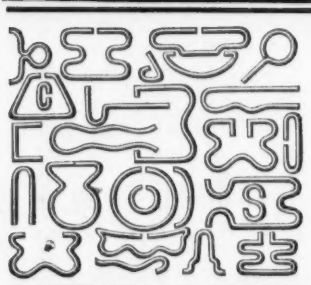

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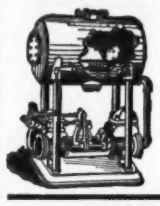

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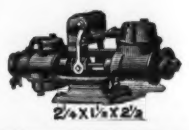

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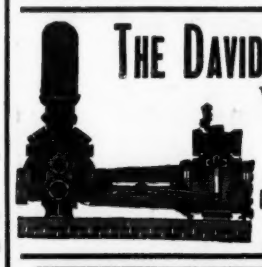

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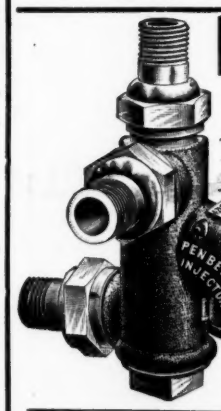

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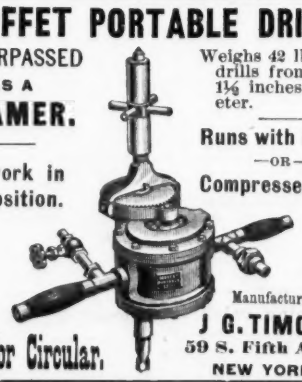

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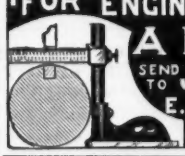

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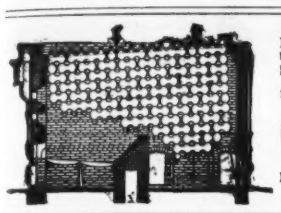

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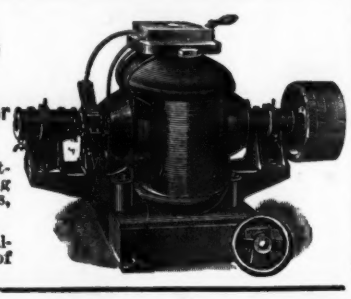

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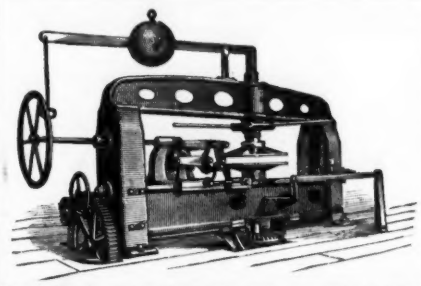

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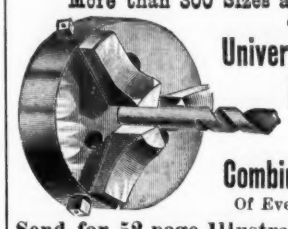

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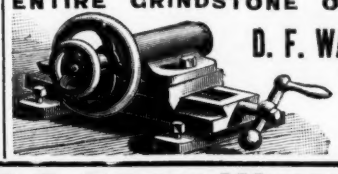

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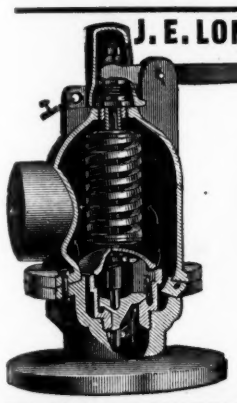

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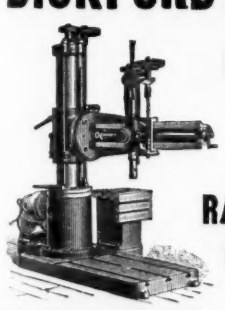

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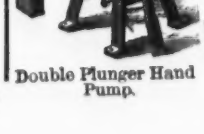

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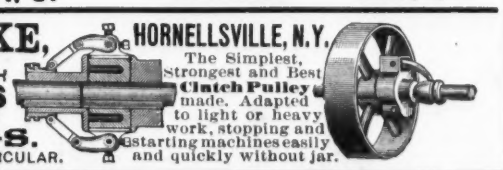

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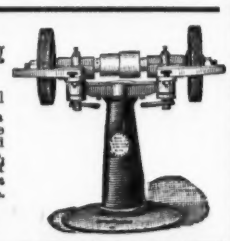

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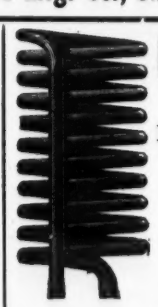

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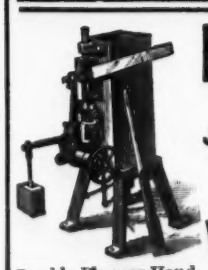

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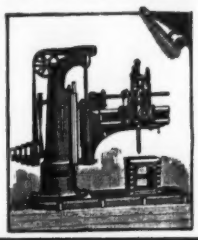

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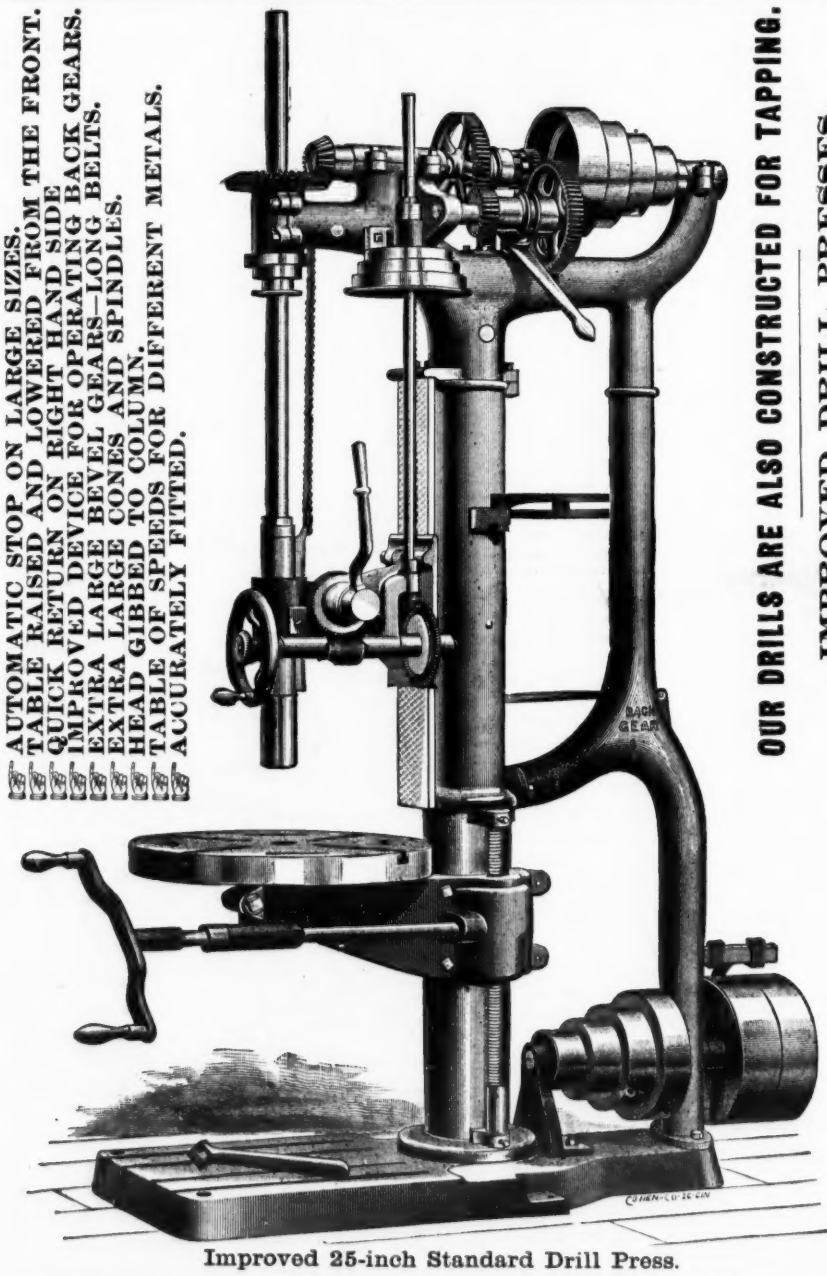

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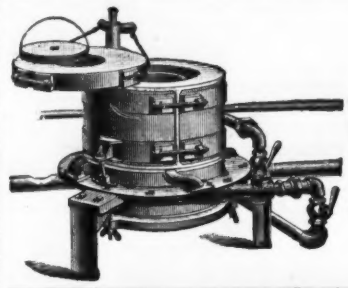

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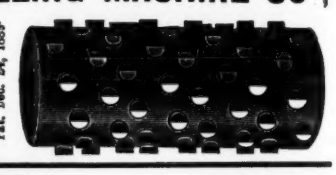
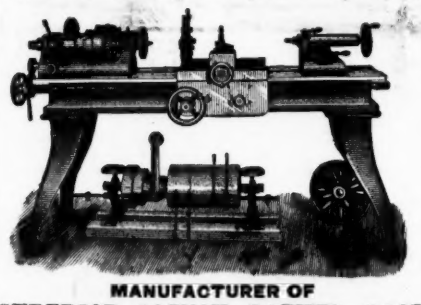


A. FALKENAU,
11th Street & Ridge Ave., Philadelphia, Pa.



MANUFACTURER OF
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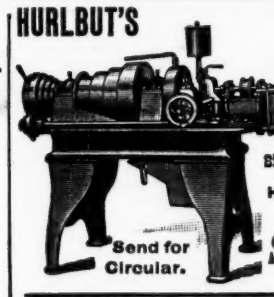
Special Machinery designed and constructed.

HURLBUT'S Patent Cutting-off and Centering Machine.



Sizes, 2", 3", 4", 5", 6".
MADE BY
HURLBUT, ROGERS MACHINE CO.
South Sudbury, Mass.
Chas. Churchill & Co., Ltd. Agents, 21 Cross St., London, England.
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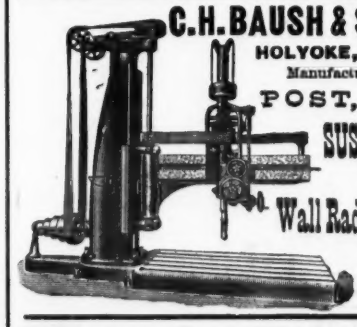
Manufacturers of
POST, SUSPENDED AND Wall Radial Drills
From the smallest to the largest.



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RADIAL DRILLS
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Gentlemen:—I am pleased to say that your Radial Drill is all you claim for it. Respectfully,
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PER WM. LODGE.

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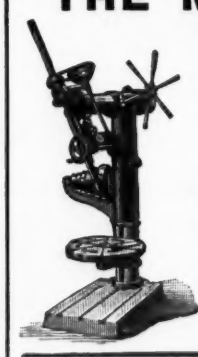

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Horizontal Drill and Boring Tools.
Column Facing Lathes.
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Electric, Steam and Hand Cranes.

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LATHES AND SHAPERS,
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Write us for Photo and Prices.

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Manufacturers of Morse Patent Straight-Lip Increase Twist Drills. New Bedford, MASS.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

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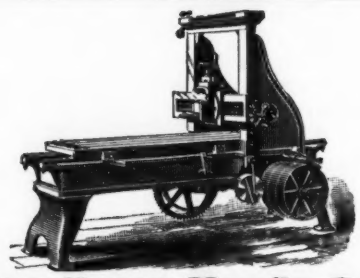

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IRON-WORKING MACHINERY.

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SOMETHING NEW.
The Cincinnati Milling Machine Co.,
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BORING AND TURNING MILLS,
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CHEAP.
No. 11x Screw Machine, with Back Gears and Power Feed to Turret.
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No. 2 Monitor Brass Lathe.
Above machines have never been used, except as show machines in New York and Philadelphia stores. Write for discount and prices. Will sell cheap for cash, as we want the room.
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With New and Valuable Features.
MADE ONLY BY THE
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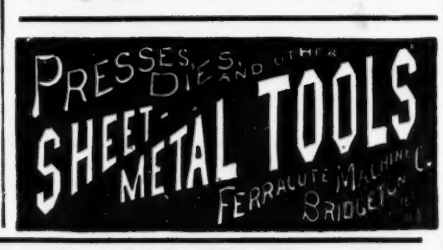

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Extra Heavy. Latest Design. All Modern Improvements.
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MANUFACTURERS OF
Steam & Gas Fitters' Hand Tools.

Pipe Cutting, THREADING, AND Tapping Machines.
SEND FOR CIRCULAR.
THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe cutter made.

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Complete line, ranging from our New Friction Disk Drill, for light work to 42-inch Back Geared Self Feed Drill.
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Lathes from 10 in. to 20 in. swing. Largest Variety of Drills manufactured in the world
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BRASS FOUNDERS
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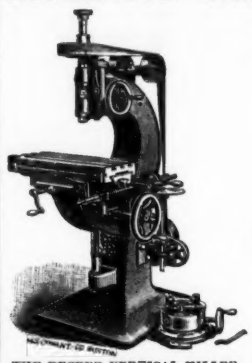

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Manufactured by WM. BARKER & CO. CINCINNATI, O.
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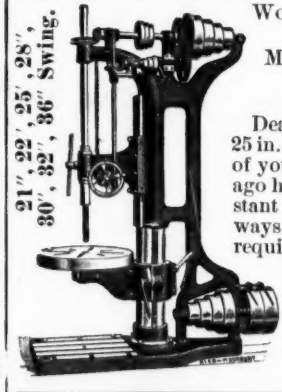

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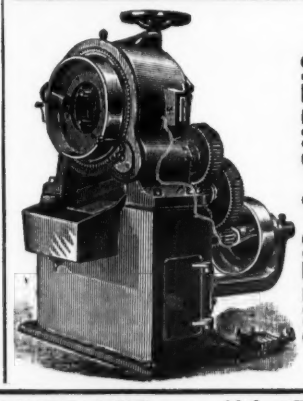
MR. J. E. SNYDER, Worcester, Mass.
Dear Sir:—The two 25 in. Drills purchased of you about one year ago have been in constant use, and have always done the work required of them to our entire satisfaction.
Yours very truly,
RICHARDSON MFG. CO.
21", 22", 25", 28", 30", 32", 36" Swing.



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66 CARDEN ST., BRIDGEPORT, CONN.
Pipe Cutting and Threading Machinery, FOR HAND OR POWER.
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES.

NEW SHOP. AMPLE ROOM.
PERFECT EQUIPMENT. PERFECT LIGHT.
NO MAKESHIFTS. EASILY REACHED.
W. D. FORBES & CO.,
HOBOKEN, N. J.
FINE TOOL AND MACHINE WORK.
CONTRACT, JOB, OR DAYS' WORK.
SEND FOR OUR NEW CATALOGUE.
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The "Simplex" Glass-Tube Cutter.
This simple little instrument will be found quite as effective in its operation as any one of the numerous Glass-Tube Cutters costing five times its price. Its trifling price places it within the reach of every one who has use for such a tool.

PRICE, 25 CENTS EACH.
Or sent by mail to any address upon receipt of a P. O. Money Order for 30 CENTS.
DO NOT SEND US ANY POSTAGE STAMPS.
It Sells at Sight.
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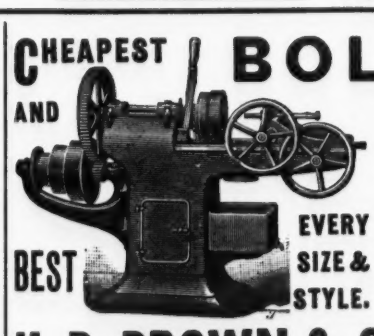
CHEAPEST AND BEST BOLT CUTTERS.



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Of all kinds for automatically controlling Steam Pressure. Manufactured by
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BUILDERS OF

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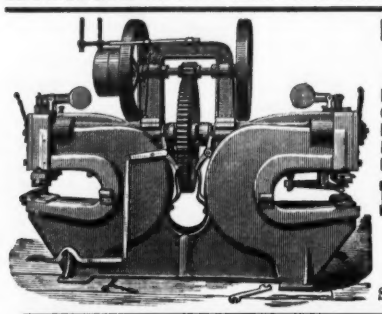
Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
High Speed Power Traveling Cranes and Hand or Power Swing Cranes, Shafting, Pulleys, Hangers, &c., for transmission of power. Improved Self-Adjusting Injector of 1876. Self-Acting Injector of 1887. Fixed-Nozzle Automatic Injector of 1885.

INJECTORS for ALL CONDITIONS of LOCOMOTIVE and STATIONARY SERVICE.



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Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven

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OVER 300 SIZES.

ALSO

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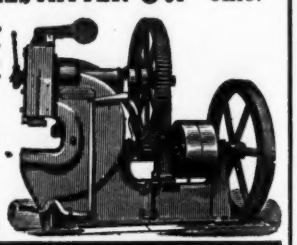


THE OPEN SIDE IRON PLANERS.

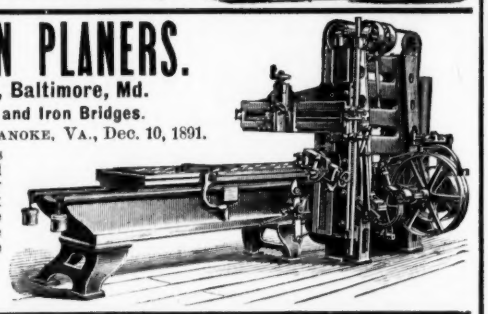
THE DETRICK & HARVEY MACHINE CO., Baltimore, Md.

AMERICAN BRIDGE & IRON CO., Steel and Iron Bridges.

ROANOKE, VA., Dec. 10, 1891.

GENTLEMEN: Answering your several favors regarding the Open Side Planer we purchased from you, we beg to say that we are thoroughly satisfied with this machine. It does its work well and a great variety of it, doing some classes of work which it would be impossible to do except in a very large machine of the ordinary style. Yours truly,

AMERICAN BRIDGE & IRON CO.
Jos. L. HUNTER, Superintendent.



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Manufacturers of

ACME BOLT & RIVET HEADERS,

Acme Single & Double Automatic BOLT CUTTERS.

Cutting from 1-8 in. to 6 in. diameter.

Also SEPARATE HEADS and DIES.

FIRST PREMIUM, CINCINNATI CENTENNIAL.

CUT

WITH OUR

NO. 3 FLEETWOOD SAW

Fitted for FOOT or STEAM Power.

A HANDY TOOL TO HAVE IN YOUR SHOP.

Write for description and price to

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FOR SALE BY

CHAS. CHURCHILL & CO., Limited,
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STRAIGHT LINE.

SYRACUSE, N. Y., April 1, 1892.

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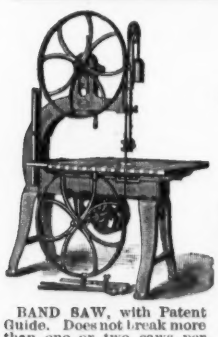
Gentlemen:—We have your **No. 3 Universal Grinding Machine** in working order, and as we are getting wheels suited to our work and a little used to the machine, it begins to grow on us, and its merits become more apparent. It is certainly as ingenious, as well designed, and as well built as any thing we have in our works, and likely better If there is anything else in the line in this country, as good or better, we are not conscious of it. Very respectfully,

THE STRAIGHT LINE ENGINE CO.
JOHN E. SWEET, Pres.



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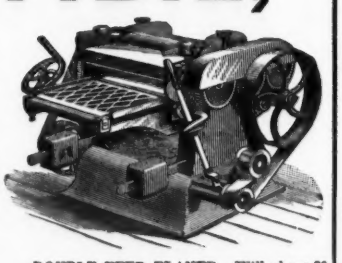
SPECIALLY ADAPTED FOR FOUNDRY PATTERN SHOPS, SHIP BUILDERS, CAR SHOPS, ETC.



BAND SAW, with Patent Guide. Does not break more than one or two saws per year. We can prove that parties broke only one blade in five years.

DOUBLE FEED PLANER. Will plane 26 inches wide and 10 inches thick. Will beat any other Planer.

Send for Cat. "A."

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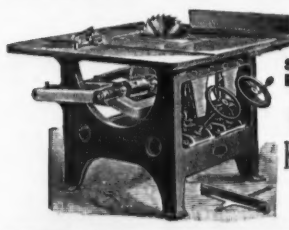

Lathes, Planers, Jointers, Saw Benches, Band Saw, &c.

Full Outfits.

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OF THE MOST ADVANCED TYPE FOR THE SAVING OF TIME AND LABOR.

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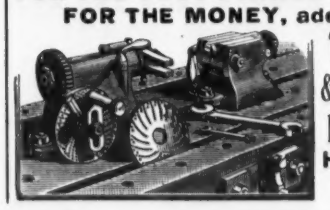

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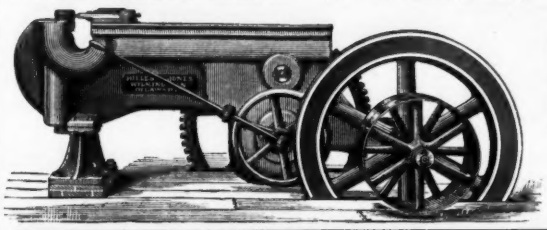
FOR

RAILROAD SHOPS, LOCOMOTIVE AND CAR BUILDERS, MACHINE SHOPS, ROLLING MILLS, STEAM FORGES, SHIP YARDS, BOILER SHOPS, BRIDGE WORKS, ETC., ETC.

NEW YORK OFFICE, EQUITABLE BUILDING.
GEORGE PLACE, Agent.

The HILLES & JONES CO., WILMINGTON, DELAWARE,



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FOR

BOILER MAKERS, BRIDGE BUILDERS, SHIP BUILDERS, RAILROAD SHOPS, LOCOMOTIVE AND CAR BUILDERS, ETC., ETC.

HORIZONTAL FLANGE PUNCHES, ALL SIZES.

WYMAN & GORDON,

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All GENUINE INGOTS & MANUFACTURES BEAR OUR REG. TRADE MARKS.

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INGOTS, CASTINGS, WIRE, SHEET &c.

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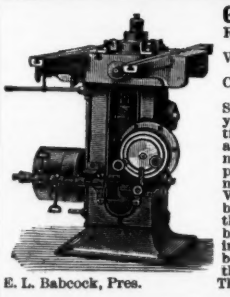

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Rack-Cutting Attachment Key-Making Machines.

VALLEY MACHINE CO., SAGINAW, MICH.

Cuyahoga Falls, O., Nov. 25, '91.

Gentlemen: The large KEY SEATER which we bought of you has now been in operation for a number of months, and we have been using it almost constantly since it was purchased, and we are very much pleased with it indeed. We also have a machine made by another firm, which we thought was a good machine, but now that we have both in our factory, and use them both, we like yours very much the best.

E. L. Babcock, Pres. The Falls Rivet & Machine Co.

Manufacturers of

Drawing Materials, Surveying Instruments, &c.

Paragon Drawing Instruments, Extra and Best Quality, German Drawing Instruments, Paragon, Duplex, Universal, Anvil Drawing, Helios, Blue Process Papers, Scales, Triangles, T-Squares, Drawing Boards, Standard Profile and Cross-section Papers. Catalogue to professional people on application.

THE ERIE KEY-SEATING MACHINE.

MANUFACTURED BY

THE BURTON MACHINE CO.,

302 Peach St., Erie, Pa., U. S. A.

C. F. McMURRAY,

New York, Office, 94 Liberty St. Boston Office, 7 Oliver St.

TROY, N. Y., March 6, 1891.

The Burton Machine Co., Erie, Pa.

GENTLEMEN:—I have your letter of the 5th inst. and I am very willing to say that your Key seating Machine is giving me satisfaction. It does its work very expeditiously and accurately, and has so wide a range that it is very profitably employed by me.

Very truly yours,
C. F. McMURRAY.

SEND FOR CIRCULAR

SPECIAL MACHINERY BUILT TO ORDER.

NEW ADJUSTABLE BENCH LEVEL.

WITH GROUND AND GRADUATED VIAL.

4-6 & 8 Inch. Three Sizes.

MANUFACTURED BY

C. F. RICHARDSON,
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THE PERKINS DRAW STROKE TRIMMER,

An Indispensable Tool for all Branch Woodworkers. Latest and Best Design. Infringers Prosecuted. Trial, not orders, solicited.

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The Morton Key-Seating Machine

THE LEADER.

With recent patented improvements, we guarantee to do the following class of work.

To cut key-ways through 1¼-inch hole in hubs or sleeves 23 inches long, in iron, brass or steel, also make it dovetail to insert feather key.

Will cut through 4-foot hub, through 5-inch hole. Our new centering chuck and setting attachment the work can be set exactly, without the use of a scale or rule. Our new binding attachment takes the place of bolts, with a key-way and key to fit it.

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THE WOODCOCK CLUTCH

Simplest and best in the world. Address

ALLENTOWN FOUNDRY & MACHINE CO.,
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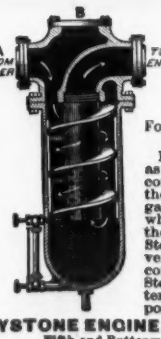

DRY STEAM.

Simpson's Centrifugal Steam Separator.

For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.

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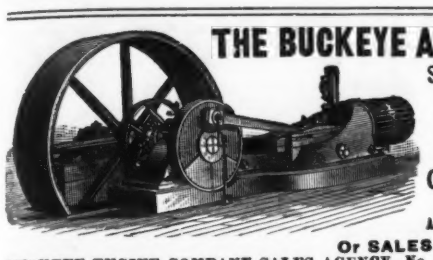

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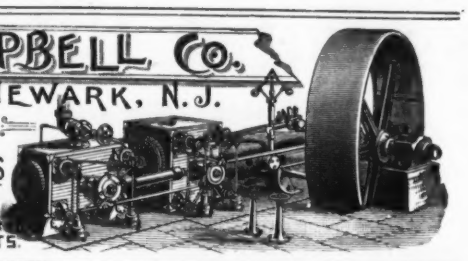

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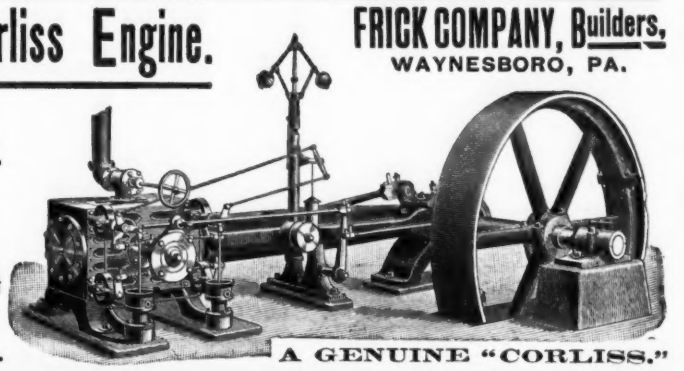

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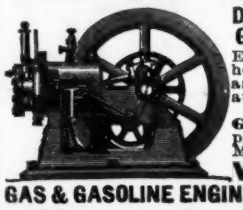

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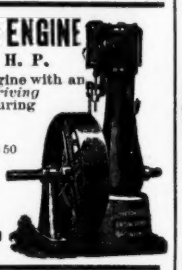

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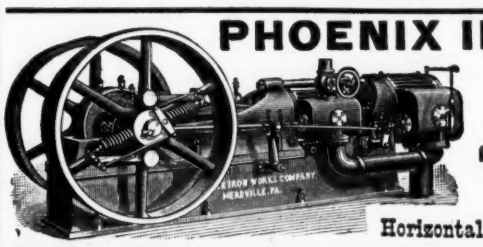

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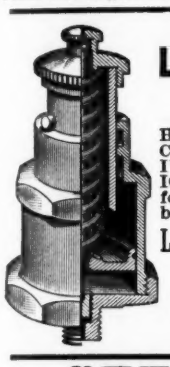

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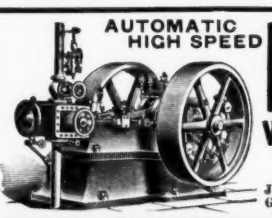

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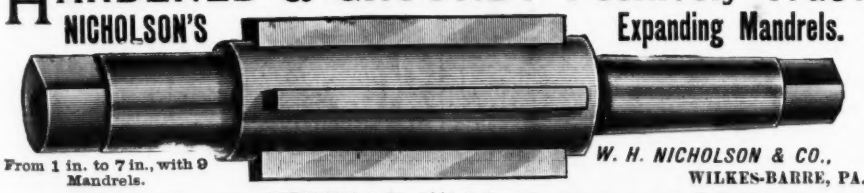

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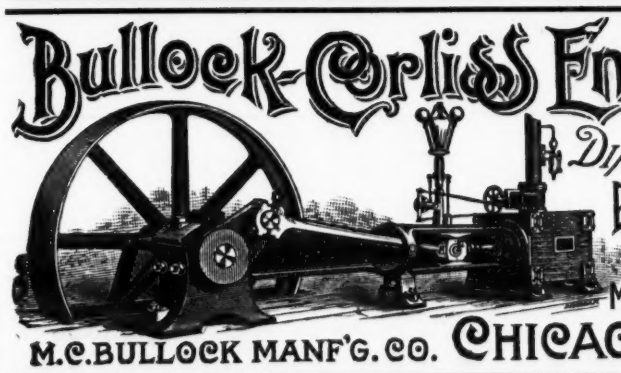

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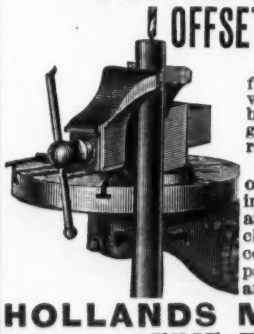

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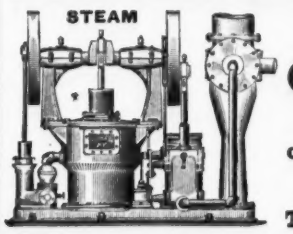

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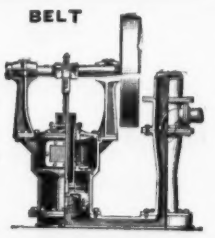

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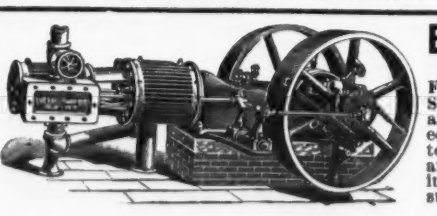

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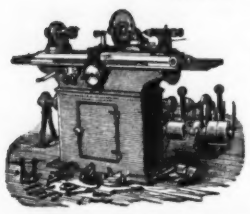

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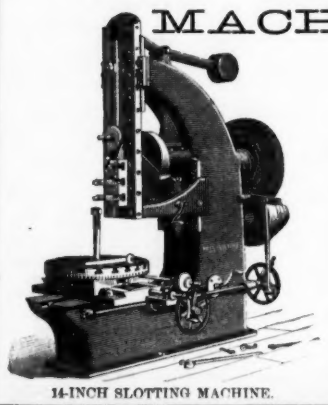

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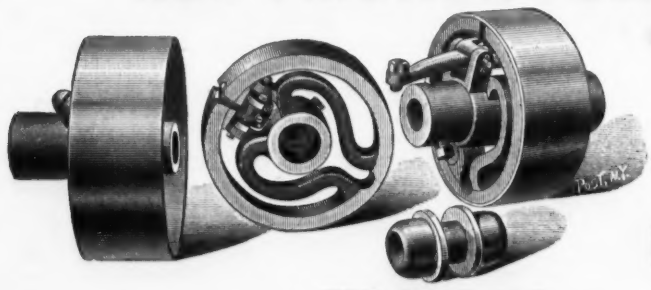

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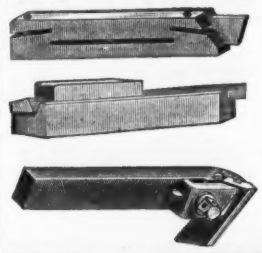

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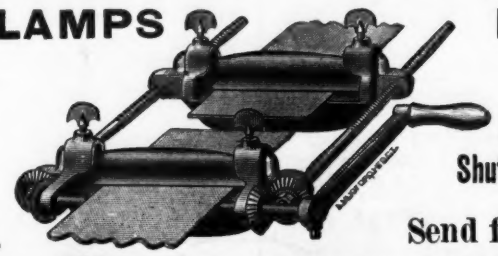

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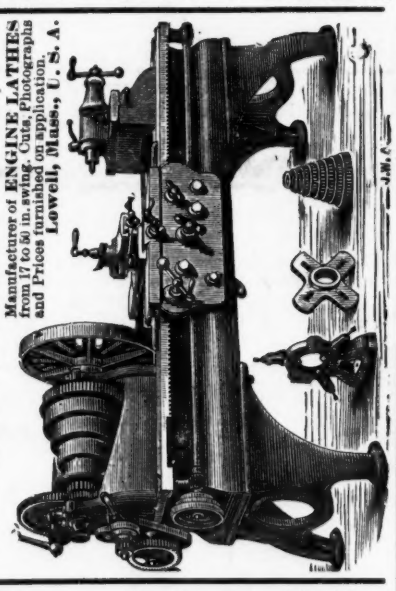

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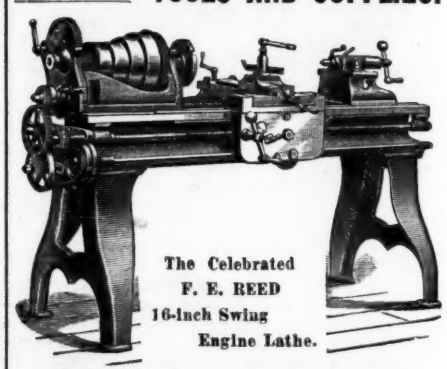

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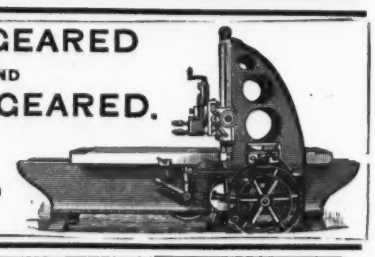

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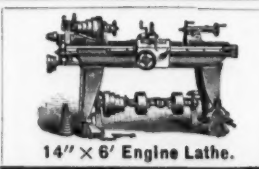
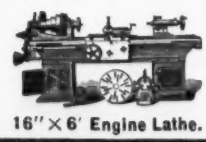
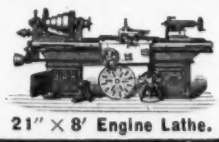


14" × 6' Engine Lathe.



16" × 6' Engine Lathe.



21" × 8' Engine Lathe.

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